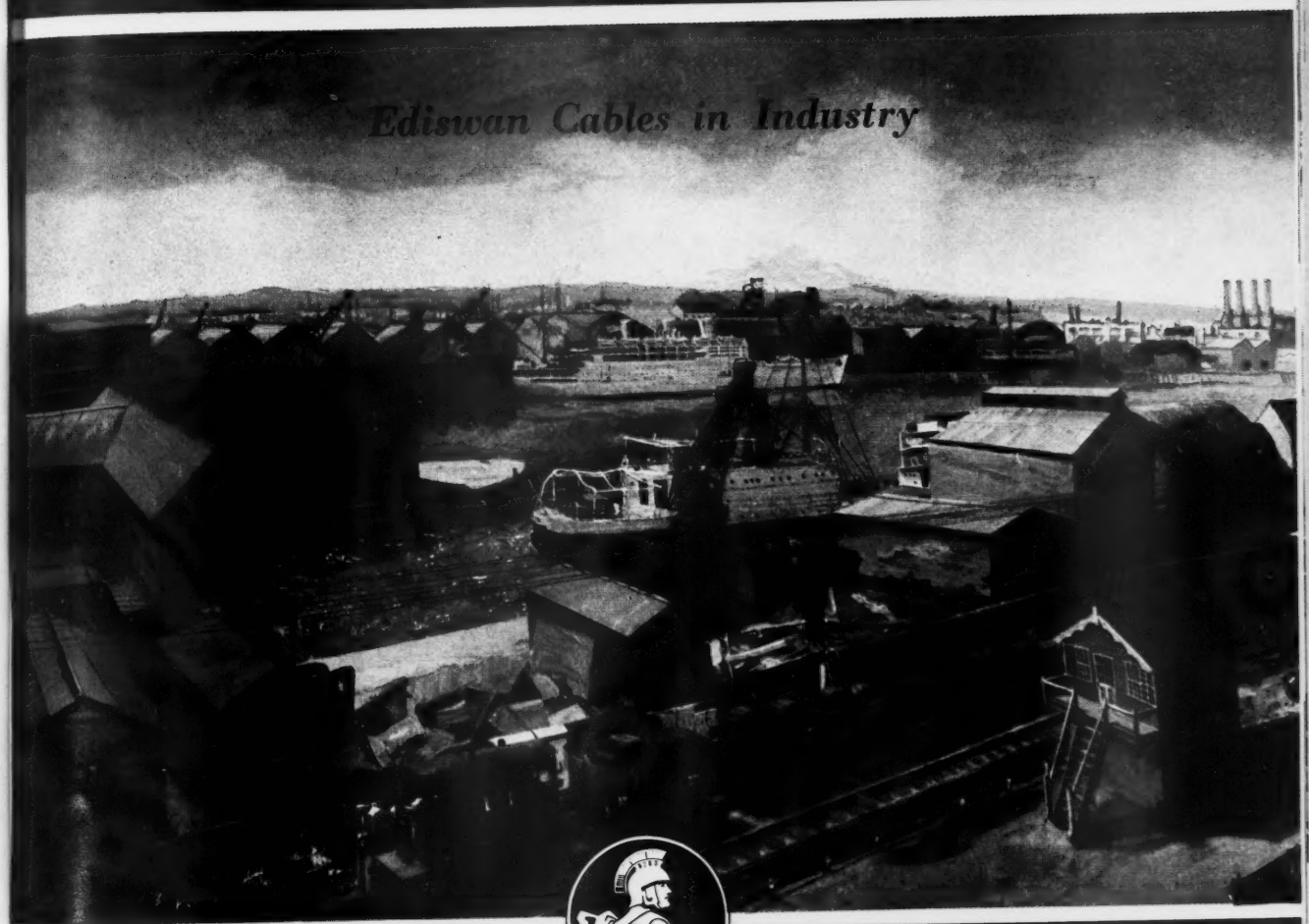
ELECTRICAL REVIEW



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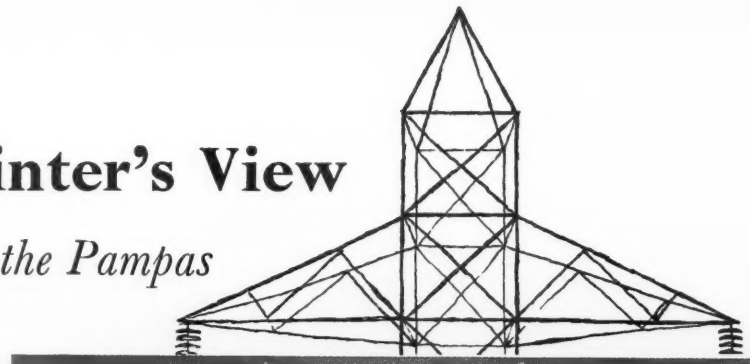
The Painter's View

Power over the Pampas



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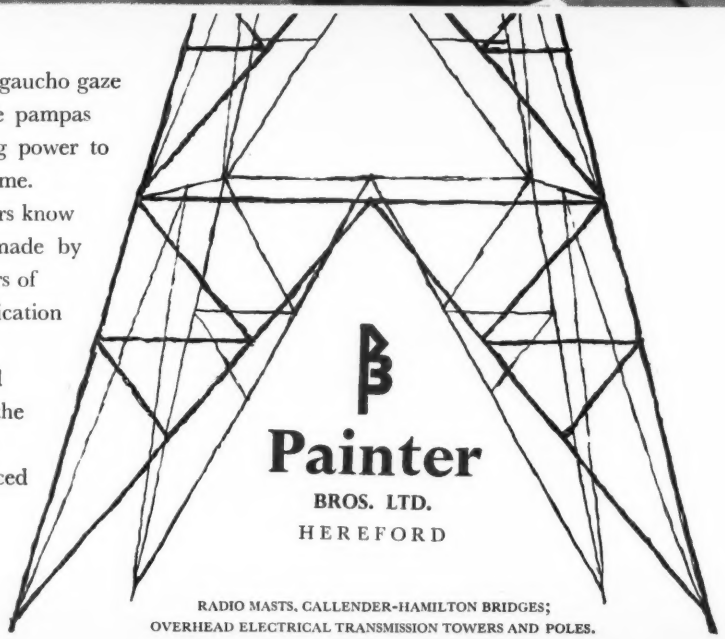

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28 JUNE
1957

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

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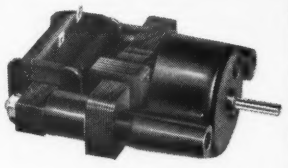

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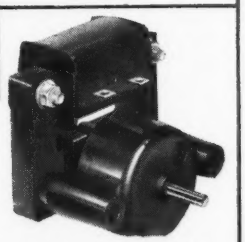

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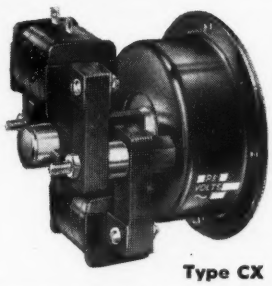

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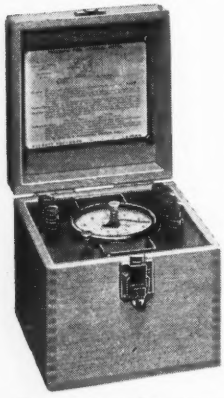

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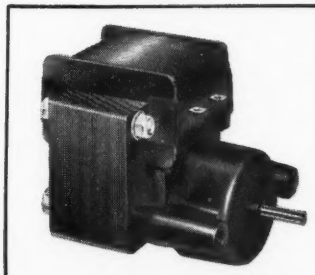

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ELECTRICAL REVIEW

28 June 1957 Vol. 160 No. 26 Established 1872

Power Stations of 1956

AT the beginning of the year it was announced by the Central Electricity Authority that the new generating plant installed during the year 1956 represented an additional output load capacity of 1,797 MW. This compares with 1,721 MW in 1955 and 1,431 MW in 1954. Although that figure constitutes a record, it is still short of the desirable annual addition of 2,000 MW to meet the anticipated growth in demand over the years. In addition to the C.E.A.'s plant, however, new plant with an output capacity of 140 MW was commissioned in power stations owned by the South of Scotland Electricity Board, making a total of 1,937 MW of additional generating capacity provided in the area of the former British Electricity Authority.

The new plant installed by the C.E.A. comprised 38 turbo-generators with an aggregate installed capacity of 1,920 MW and 50 boilers having an aggregate evaporative capacity of 18,715,000 lb/hr, together with three diesel engined generators with an installed capacity of 3·99 MW. Altogether, new plant was installed in 33 stations and in four of these plant was installed for the first time. In these new stations, Castle Donington, Hams Hall " C, " Tilbury " A, " and Machynlleth " B, " a total of nine generating sets representing 404 MW was installed; ultimately these stations will have an aggregate capacity of 1,324 MW. During the past few weeks we have visited these stations and an article describing the first of them, Castle Donington, is published in this issue. We have also been to the Barony station of the South of Scotland Electricity Board, where two 30 MW sets with boilers designed to burn slurry are being installed. Descriptions of this and the other stations will appear during the next few weeks.

The continued demand for more and cheaper power has brought about the design of larger individual generating units to achieve the highest possible efficiency. Nowadays the most common steam conditions are 900 lb/sq in and 900 deg F and 60 MW sets are the order of the day. During last year twenty-four sets of this size were installed as opposed to twelve 30 MW units, but it is unlikely that the 60 MW set will remain the " standard unit " for very much longer. The most likely design of plant to become commonplace is that installed in Castle Donington where the steam conditions are 1,600 lb/sq in and 1,060 deg F and 100 MW sets are employed.

There are now several stations operating in this country with these advanced steam conditions and there is no doubt that their number will increase materially in the very near future but with much larger individual turbo-alternator/boiler units. Still higher steam pressures are being advocated and it is not unlikely that before many years have passed, we shall see 500 MW sets operating at pressures around, or even above, the critical mark in the quest for increased thermal efficiency.

LARGE GENERATING UNITS

From some of the remarks made in the discussions at the British Electrical Power Convention at Eastbourne last week there seems to be doubt in some quarters as to whether the rapid increases in the sizes of generating sets are fully justified. Although the very large machines are of some value for "window display" purposes to stimulate exports their value to the British electricity supply industry was, according to some speakers, open to question. Mr. R. L. Batley instanced the 550 MW units at present being constructed. Since they consist of two 275 MW units there will be little saving in building and civil engineering costs. The gain in thermal efficiency is small and the saving in capital cost is likely to be marginal.

When comparing the large machine with one half its size these marginal savings would soon be outweighed by the operating loss which would result from an "outage." It is thus evident that our designers must exercise caution when advocating increasingly large generating units as we may find that we have too many eggs in one basket.

WELDING

Speakers at the Commonwealth Welding Conference (the early stages of which are reported in this issue) have referred to the virtual impossibility of constructing the large plant in modern power stations without recourse to fabrication on a very large scale. Recent advances in welding techniques have also greatly facilitated the more economic use of complex-alloy steels required to withstand high temperatures for long periods.

Site welding has become of increasing importance on account of the limitations of transport systems in regard to the size and weight of plant components that can be dealt with. Much of the recent increase in output and efficiency of nuclear reactors derives from the ability to weld pressure vessels of a greater thickness and strength than was formerly possible.

MINING ELECTRICAL ENGINEERS

In delivering his presidential address to the Association of Mining Electrical and Mechanical Engineers' annual conference last week, the proceedings of which are reported elsewhere in this issue, Mr. J. E. Ridley referred to Mr. D. J. Morton's revelation last year that for every new mechanical member of the Association there were three to four new electrical members. Mr. Ridley thought the reason for this might be that the Association was first formed in 1909 by electrical engineers for electrical engineers and that when the name of the Association was changed to embrace mechanical engineers in 1941 there was then, and there still is, a preponderance of electrical engineers.

These facts suggest at least superficially the need for a separate organisation for electrical mining engineers. But Mr. Ridley's repeated references to the Institution of Electrical Engineers prompts the question: why should not the highly specialised mining electrical engineer be represented by his own section of the I.E.E.?

It may be true that the coverage of the existing I.E.E. sections, namely supply, utilisation, measurement and radio, is very much wider, but can we say that in electrical or even general industrial importance mining electrical engineering is not at a higher level than say radio-electrical engineering?

We believe that this is rather a reiteration of thoughts of very many years ago, long before the days of radio, but we think that it is still a subject worthy of consideration by leaders of the electrical profession.

ACT OF FAITH

One of the questions put to the panel at last week's Electrical Forum suggested that it was perhaps unwise to proceed with generating plant extensions on the assumption that the demand for electricity would double in a decade or less. It gave Lord Citrine an opportunity of affirming his belief in the soundness of this assumption, although he agreed that it was an "act of faith" to install plant at the projected rate. Economists had tried to put the brake on but in his opinion there were no foreseeable limits to electrical expansion. We may recall that it was largely economists' caution (although there were of course other influential factors) which resulted in the post-war shortage.

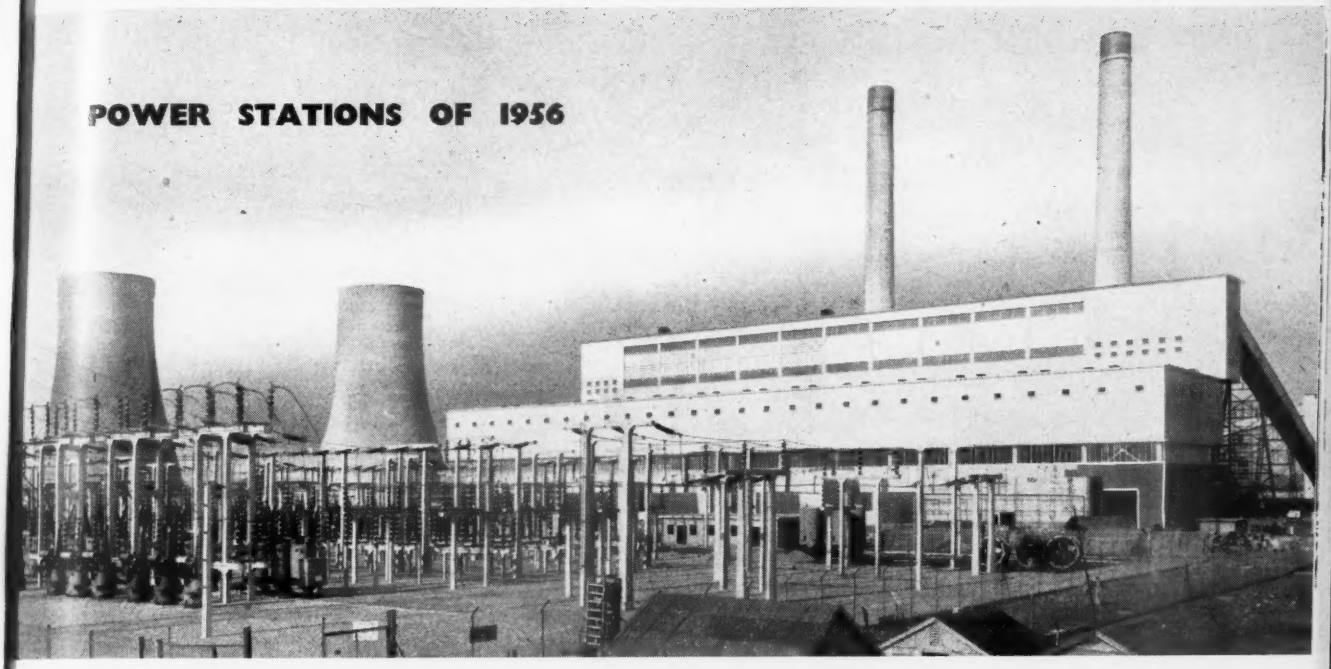
Reinforcing Lord Citrine's views, Mr. J. S. Pickles pointed out that in the United States, where the consumption per head was roughly twice as much as in this country, the generating plant installation programme was based on the expectation of a doubled demand in ten years.

ABLE AND WILLING

Doubts implied in another question raised at the Electrical Forum were set at rest—with a qualification. It was asked whether it was possible for British electrical manufacturers to keep up their exports while they were meeting the heavy requirements of the electricity supply industry for generating plant. This was naturally a question for Col. B. H. Leeson, the director of the B.E.A.M.A., who said that the manufacturers were quite capable of carrying out this double task. There was, however, one thing which might hinder them. The requirements for steel engendered by the nuclear power plant programme were very heavy, but they hoped that the projected new steelworks which were planned would be got into operation in time to meet the demand. The electrical manufacturing industry planned to export a third of its production. Col. Leeson's convictions were supported by Mr. J. O. Knowles, chairman of the B.E.A.M.A. Council.

ELECTRIC FIRES

Next week's issue of the *Electrical Review* will include a comprehensive illustrated survey of domestic electric fires, with details of type, loading, elements, finish, price and purchase tax, etc. Low temperature heaters will be dealt with in the 26th July issue



CASTLE DONINGTON

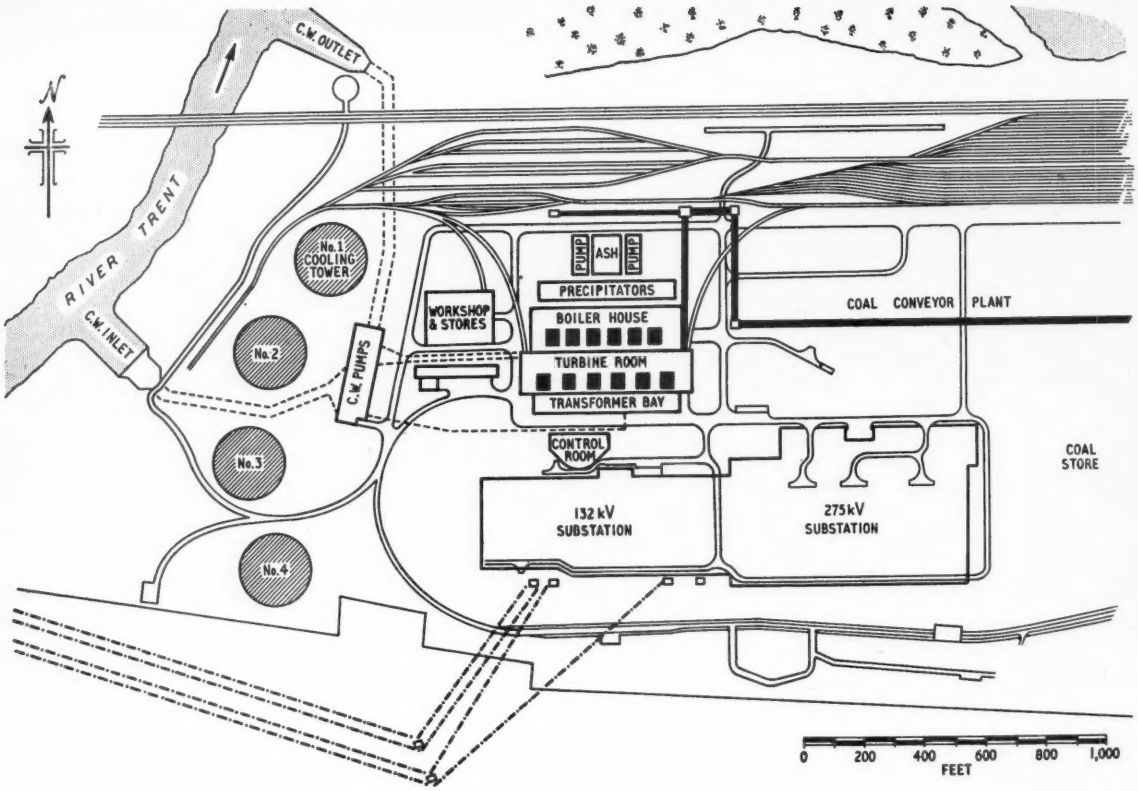
ADVANCED STEAM CONDITIONS IN 600 MW PLANT

A FEW months ago the largest single generating station so far built in this country had the first of its ultimate six 100 MW turbo-alternator/boiler units put into commission with steam conditions at the turbine stop valve of 1,500 lb/sq in and 1,050 deg F. Castle Donington, as it is known, is situated in Leicestershire on the south bank of the River Trent about seven miles to the south-east of Derby. Altogether the site comprises some 190 acres which is bounded to the north by a loop in the River Trent. The British Railways line from Weston-upon-Trent to Sawley passes across the north of the site and road access is obtained from the A453 road from Ashby-de-la-Zouch to Nottingham. The site is also very near to the South Nottinghamshire coalfields from which most of the fuel to be burned in the station will be obtained. The estimated cost of the completed station is £36 million, which is equivalent to £60/kW of installed plant.

The main station building, consisting of the turbine room, boiler house and auxiliary plant bays, is 560ft long by 280ft wide and the height of the boiler house is 150ft. The size of the building has been kept to the minimum, representing 28 cu ft per kW of installed capacity, which compares favourably with other modern stations. The reinforced concrete foundations are extended to a height of 35ft above basement level to form the walls of the main building up to operating floor level. The exterior of the building is of utilitarian construction and yet the overall appearance is pleasing. The gable ends of the concrete walls are faced with pre-cast granite panels, while the boiler house walls above operating floor level consist of adjustable metal louvres with asbestos cement sheeting and patent glazing. The turbine house walls are also of asbestos cement sheeting with a horizontal strip of patent glazing 11ft high. The reason for using these materials was to achieve the maximum economy in building costs.

The two circular reinforced concrete chimneys are 425ft high and supported on concrete rafts each with 209 bored concrete piles. They are lined with acid- and heat-resisting bricks, the internal diameter at the top being 23ft. To augment the supply of cooling water from the River Trent during the summer months four reinforced concrete cooling towers are being built, each 300ft high and 200ft in diameter at the base. The control room, administrative offices, workshop and stores are in separate buildings situated adjacent to the main buildings. Particular attention has been paid to the layout of the first-aid centre, canteen and kitchen. Locker rooms and amenities for the workpeople are situated mainly in separate small buildings adjacent to their places of work.

The unit system of operation for which the station is designed implies a lack of interconnections between each of the six turbo-alternator/boiler units. In the turbine room the machines are arranged transversely across the building, the auxiliaries associated with each machine being arranged on either side of the turbo-alternator foundation block. Outside of the turbine house on the south side are the transformer bays accommodating the main 120 MVA generator transformers and various unit, station and auxiliary transformers. Between the south side of the turbine room and the transformer bays, the auxiliary switchgear and battery bay stretches the full



Site plan of Castle Donington generating station

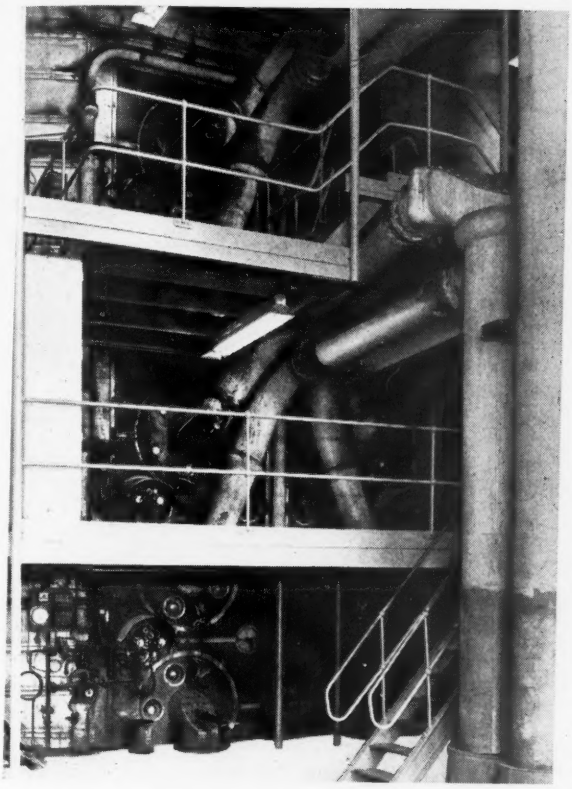
length of the station with the cable tunnel beneath it. The boiler house is to the north of the turbine room and between the two is the auxiliary bay accommodating the plant control rooms, de-aerators and tanks at intermediate levels.

Castle Donington is of unusual interest in that it is the first plant in this country to have single turbo-alternator/boiler units of 100 MW rating, and with evaporating capacities of 830,000 lb/hr the boilers will, for some time to come, be the largest in Europe. The design of these boilers represents a logical development of the radiant principle; but apart from their outstanding size, their capacities being one-and-a-half times that of any boiler so far made in this country, they have many noteworthy features, among which are the twin furnaces with their dividing screen of bare water tubes, the use of burner selection for coarse control of steam temperature, and the provision of an auxiliary primary air heater to facilitate the handling of wet coals. The station is for base load operation with an expected daily load factor of 100 per cent and an annual load factor of 85 per cent. Under these conditions, with six units in operation, the daily coal consumption will be about 7,000 tons, based on a calorific value of 10,000 B.Th.U/lb.

All coal is delivered to the site by rail and the wagons are emptied by four side-tipping tipplers, the wagons being removed from the tipplers by electric capstans. Each tippler is equipped with an automatic weigher. From the tipplers the coal is transported to the boiler house or the 500,000 tons capacity storage area by a series of belt conveyors, which are provided with electromagnetic vibrating feeders at the tipplers and junction towers, together with coarse coal crushing equipment and electromagnetic overband separators. Coal is stocked out or reclaimed from the store by belt conveyors running the full length of the storage area, which work in conjunction with a travelling transporter, a ground hopper for reclaiming, and an automatic belt tripper for stocking out. Bulldozers are also used to move coal across the storage area. The total conveyor capacity from the tipplers to the bunkers, and from the store to the bunkers, is 960 tons/hr, i.e. two belts each of 480 tons/hr capacity. There is also a 480 tons/hr belt from the tipplers to the storage area.

One coal bunker of 1,000 tons capacity is provided for each boiler, and this feeds five Type E70 Babcock & Wilcox pulverising mills, each of which has a maximum capacity of 13 tons/hr and is driven by a 150 b.h.p. 3·3 kV L.D.C. motor. These mills are of the pressure type and receive air from individual Howden primary air fans driven by 188 b.h.p. 3·3 kV L.D.C. motors. Two Newton Chambers primary air heaters of the cast-iron needle type are installed for each boiler to boost the primary air temperature when wet coal is received. Coal is fed to the mills by two-speed rotary table feeders, which are integral with the mills. The pulverised fuel is conveyed from the mills to twenty 11in horizontal circular type burners in the front wall of each boiler.

In addition to the main p.f. equipment, there are twelve pressure-atomising oil burners with automatic spark ignition and these are also fitted in the front wall of the boiler. This equipment is capable of carrying a boiler load of 10 per cent m.c.r. and is automatic in operation with remote control from the plant control room. The pressure of oil to the burners is 300 lb/sq in and the maximum capacity of each burner is 800 lb/hr. As part



P.f. burners and automatic oil burners seen from firing floor level

of the ancillary equipment there are three 40 ton oil storage tanks, two pumping and heating units, three pressure pumps, two filling pumps and associated equipment.

After combustion the ash falls into a twin type water filled ash hopper at the base of each boiler, from which it is discharged by a Babcock & Wilcox "Hydrojet" sluicing system and conveyed to ash sumps. The ash is removed from here by a grab crane and put on to a drainage apron where the water and fine ash are drained off to the dust sumps, after which the coarse ash is grabbed into lorries for removal. The boilers are each equipped with twelve precipitator dust hoppers from which the dust is ejected by high-pressure water jets. Each boiler also has six air heater and economiser dust hoppers, while each chimney has four dust hoppers. From these points dust is ejected into the dust sluices by hydrovactors via windswept valves fitted with automatic vacuum breaker valves. The dust slurry is sluiced to the dust sump whence it is pumped to disposal pits about three miles away.

Four 2,700 gal/min high-pressure water pumps, driven by 320 b.h.p. 3·3 kV L.D.C. motors, are provided for sluicing the ash and dust to the sumps, while four 290 h.p. dust pumps convey the dust slurry to the disposal pits. There are two 2,400 gal/min pumps, driven by 185 b.h.p. 3·3 kV motors, at the disposal pits to return the water to the reservoirs.

Steam Raising Plant

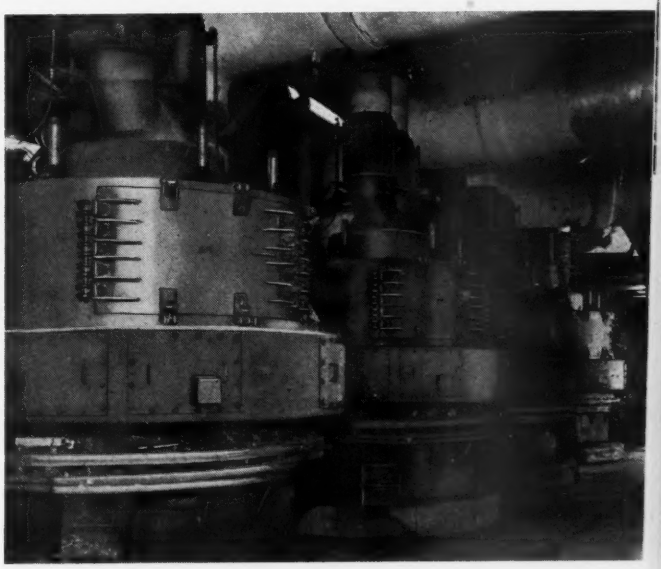
The completed station will accommodate six Babcock & Wilcox single-drum boilers, each with a maximum continuous rating of 830,000 lb/hr when using feed water with a temperature of 400 deg F at the economiser inlet. The steam conditions at the superheater outlet are 1,600 lb/sq in and 1,060 deg F. Each unit consists of radiant boiler, primary and secondary superheaters, economiser, air heaters and f.d. and i.d. fans, together with fuel pulverising plant and oil burning lighting-up equipment. The boiler and furnace section constitute twin furnace chambers of the fully radiant type without convection surface. The twin furnace is formed by an additional central water wall, which reduces the ratio of furnace volume to cooling surface and allows a lower temperature gradient between the centre of the furnace and the water walls. The drum, water walls, boiler and superheater are suspended from the main building steelwork, the total weight being nearly 2,000 tons.

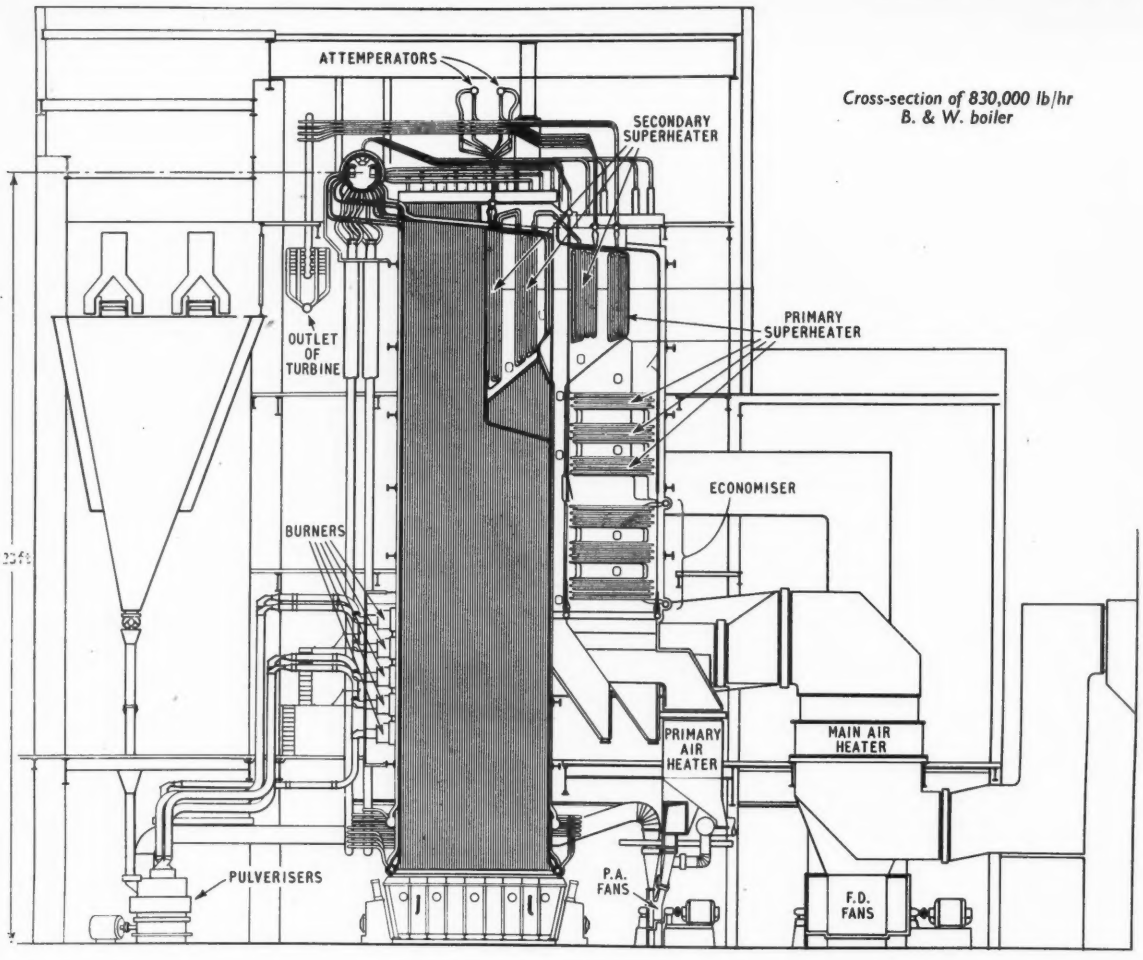
The primary superheater is in three banks and is of the horizontal self-draining type feeding a pendant section, while the secondary superheater is of the pendant type. Interposed between the two sections of the superheater is a pair of spray-type attemperators which control the final steam temperature to within ± 15 deg F of the desired figure. Coarse control of steam temperature is obtained by selection of the fuel burners, which are arranged in tiers.

A three-element air-operated Bailey system of superheated steam temperature control is employed and this takes into account total air flow, spray water flow, and the steam temperature. The air flow representing boiler load applies the primary element immediately a change in load or combustion conditions takes place, thereby anticipating the imminent change in steam temperature. The measurement of spray water flow to the nozzles provides a stabilising effect in which the time lag in the superheater mass can be taken into account when calibrating the system.

As already mentioned, five p.f. mills are provided for each boiler, and four of these can maintain the maximum boiler load with normal fuel supplies. Two Howden 151,000 cu ft/min f.d. fans, driven by 328 b.h.p. 740 r.p.m. 3·3 kV L.D.C. motors, deliver the necessary air to the burner windbox for combustion of the pulverised fuel. Five primary air fans, drawing air from the f.d. ducting via the primary air heaters, are used to convey the fuel from the mills to the burners.

Each boiler is equipped with five 13 tons/hr pulverising mills





Cross-section of 830,000 lb/hr B. & W. boiler

Gases from the furnace traverse the various sections of the superheater and pass through the plain tube continuous loop economiser in two ductings to the main air heaters, which are of the Howden-Ljungstrom rotary regenerative type. Next in the gas circuit are two Sturtevant tubular electrostatic precipitators, which are designed for vertical gas flow. The casing housing the equipment is of reinforced concrete with a double-sided inlet flue; the discharge and receiving electrodes are provided with electrically-operated rapping gear. The throughput of each half-collector is 232,500 cu ft/min at 290 deg F and 11 per cent CO_2. The guaranteed efficiency of the plant is 96 per cent at the design load. Gases from the precipitators are exhausted by means of two Howden 240,000 cu ft/min i.d. fans, driven by 833 b.h.p. two-speed L.D.C. motors, into the two chimneys, which are connected together and to the fans by a main flue.

For on-load cleaning, each boiler has 48 electrically-operated soot blowers and 28 similar units for future installation all arranged for automatic sequence control. In addition, there are eight manually-operated blowers for cleaning the main air heaters. Of the 48, there are 20 Babcock & Wilcox rack blowers for cleaning the superheater and economiser sections, while the remainder are of the Babcock & Wilcox single-nozzle retractable pattern for cleaning the furnace rear and side walls.

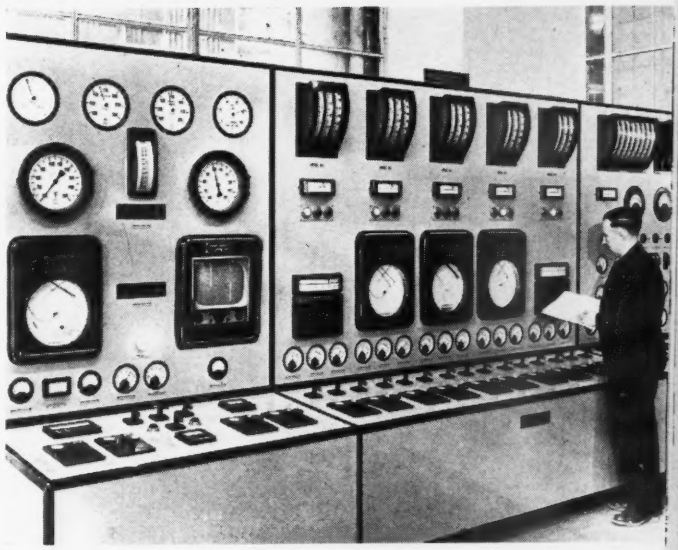
Turning now to the water circuit, it will be remembered that the boilers are of the single-drum type, and eight downcomers supply water from the drum to the furnace wall lower headers, of which there are eight. These then feed the furnace water walls, including the dividing wall, from which the water is returned to the drum. Steam and water from the furnace walls pass through seventy 11½in conical separators in the drum to extract the moisture. Steam from the drum is then conveyed to the superheater inlet header by twenty-four 4in o.d. outlets distributed along the length of the drum, having first passed through plate-type scrubbers to dry it.

Boiler Control System

Automatic boiler control is carried out by means of a Bailey air-operated system. Variations in main steam pressure are sensed and transmitted to the f.d., i.d. and p.a. fans. Variations in f.d. alter combustion chamber pressure, while variations in i.d. maintain the required suction. The two-speed table feeders which supply the p.f. mills with coal are controlled by the p.a. fan and mill differentials. Thus, falling steam pressure calling for a higher combustion rate provides (1) more f.d. for combustion, (2) more i.d. to balance against the increase in f.d. and maintain correct suction and (3) an increased amount of primary air through the mills to clear them of coal more rapidly, thereby altering the differentials and providing the extra fuel required to meet the new steam demand. Provision is made within the boiler control system for remote manual operation of all control dampers. Isolating dampers and regulating dampers for gas and air flows have Lockheed hydraulic controls.

The water level is maintained in the drum at a pre-set level by the pneumatically-operated Bailey three-element system which takes into account steam flow, feed flow and drum level. The feed and steam flows are accurately measured and balanced against each other by means of a differential linkage which operates a pilot valve and sends out a neutral loading pressure of 15 lb/sq in provided the rate of feed input equals the rate of steam output. Any difference here alters the pilot valve setting and sends out a loading pressure proportional to that difference, which passes through a differential relay and selector valve to alter the setting of the feed valve. The drum level meter, acting according to changes in the feed water valve position, sends out a loading pressure which alters the feed valve position and so maintains the drum level constant.

In view of the steam pressures and temperatures employed at Castle Donington the pipework between the boiler and the turbine stop valve has a nickel/chromium/vanadium/molybdenum content. The joints are butt welded with bolted loose ring backing flanges and they have all been subjected to non-destructive tests.



Boiler control panel in unit control room

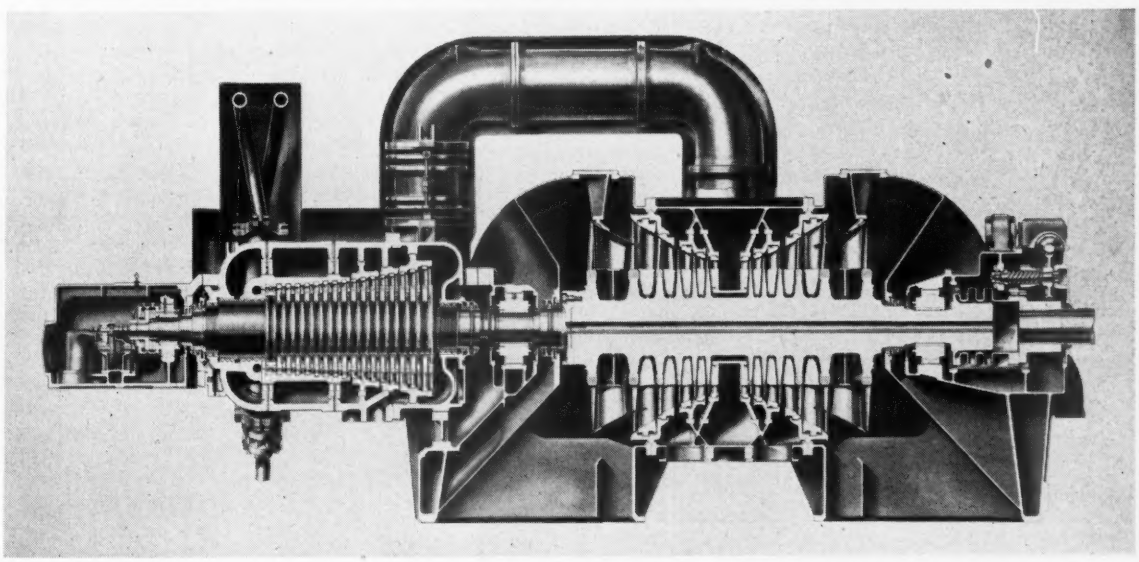
Generating Plant

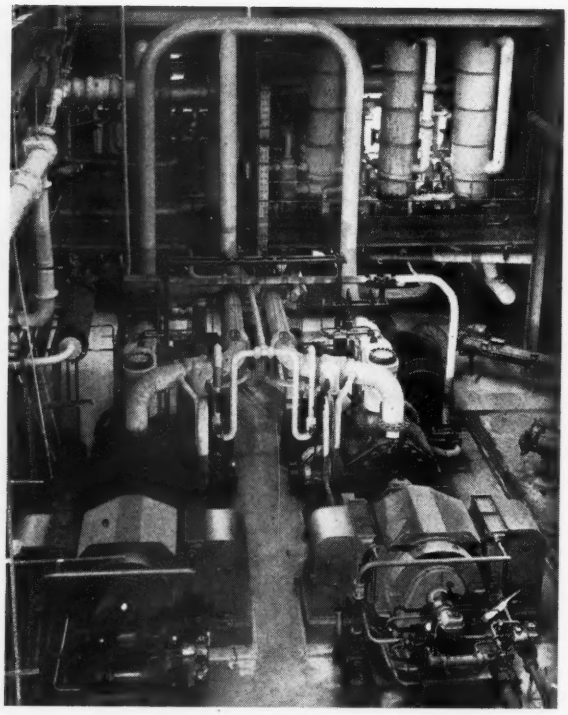
Six 100 MW 3,000 r.p.m. Metropolitan-Vickers turbo-alternators, each complete with its own surface condensing and feed heating plant, are being installed. The turbines are of two-cylinder impulse design with a double-flow l.p. cylinder. There are 16 h.p. stages and five l.p. stages on each side, including a Baumann multi-flow exhaust stage. The stop valve conditions of the turbine are 1,500 lb/sq in and 1,050 deg F. The station is designed to have an overall thermal efficiency of about 32 per cent (on kWh sent out) and, in fact, this figure has already been approached by No. 1 unit. The overall length of the units has been kept to the minimum by the use of a two-cylinder, three-bearing design incorporating increased mean diameters for the h.p. blading, forged construction of both h.p. and l.p. rotors, except in the case of the l.p. rotors of Nos. 1 and 2 machines, and the adoption of a rigid coupling between the h.p. and l.p. shafts.

Owing to the high terminal steam conditions, the h.p. cylinder is of double-casing design and slip-ring joints are fitted to the steam admission pipes to prevent leakage from the inner to outer cylinders, these rings also allowing for differential expansion between the two cylinders. To ensure that correct alignment is maintained under all operating conditions, provision is made to allow free axial and transverse expansion of the machine, which is anchored at the extreme ends of the exhaust chamber so that all axial movement takes place from this point. Two steam chests, machined from solid steel forgings, are mounted alongside each turbine and each contains a governing valve and combined stop and emergency valve with steam strainer; two loop pipes from each chest convey the steam to the h.p. cylinder. The governor gear is enclosed in the h.p. end bearing pedestal with the main oil pump, which supplies oil to the turbine bearings at 10 lb/sq in and to the governor control gear at 90 lb/sq in. All the relay oil passes to the governor system through an oil relay emergency trip valve.

Steam for feed water heating is bled from the turbine

Cross-section of Metropolitan-Vickers 100 MW three-bearing turbine with forged h.p. and l.p. rotors having integral discs and shafts





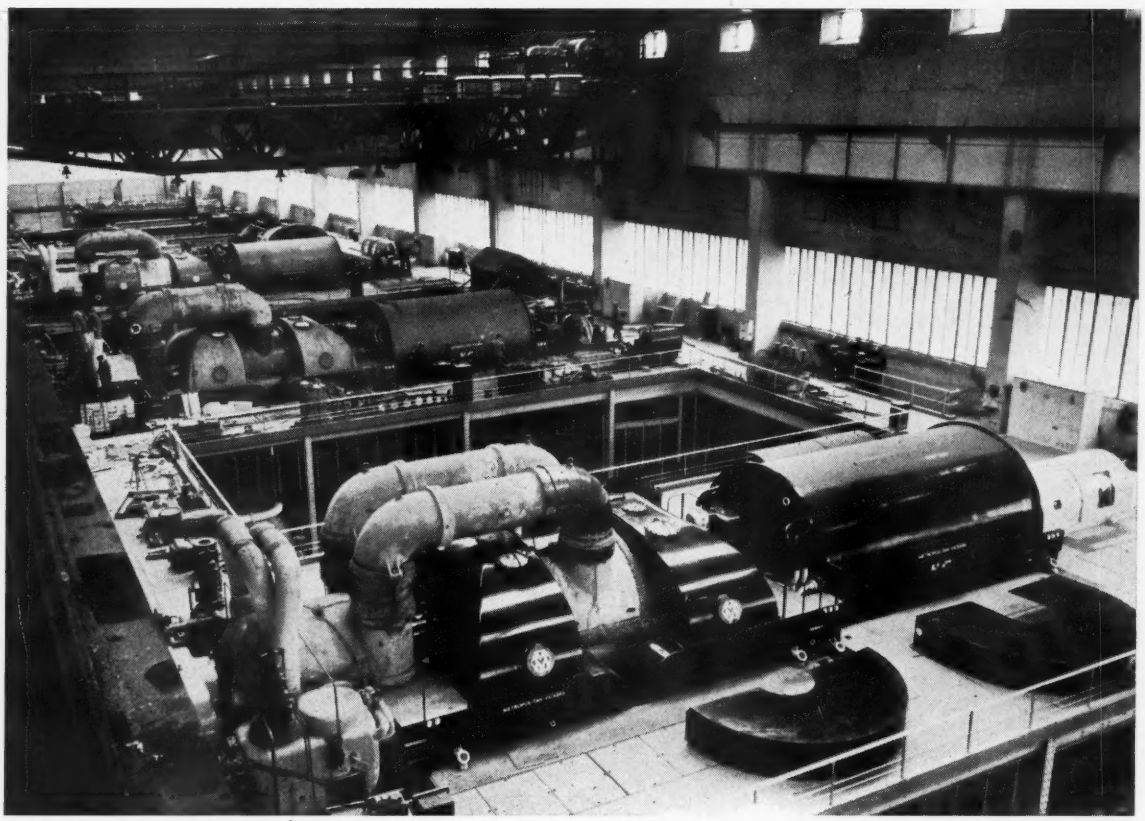
Two 3,140 h.p. feed pumps are provided for each turbine/boiler unit

at six points leading to six stages of the regenerative feed heating train. The first three stages are l.p. heaters, the third being a high level de-aerator heater operating above atmospheric pressure down to about 50 per cent of the full load. The last three stages are h.p. heaters and these are divided into two 50 per cent capacity banks in parallel. The final feed temperature at full load is 400 deg F.

From the double-flow exhaust of the l.p. turbine cylinder the steam passes into twin two-pass condensers with a total cooling surface of 80,000 sq ft. They are designed to give a vacuum of 28·9in Hg at m.c.r. when supplied with a quantity of 64,000 gal/min at 60 deg F. Condensate is extracted from the condensers by two 100 per cent duty 700,000 lb/hr extraction pumps, while air is removed from the condensers by three 50 per cent duty 135 lb/hr Leblanc type motor driven air pumps and a separate motor driven quick-start exhauster is also provided. For raising the siphon in various parts of the auxiliary cooling water system a vacuum bus main is installed which is connected to the auxiliary rotary air exhausters.

The extraction pumps discharge through the l.p. heaters to the de-aerator, the storage tank of which supplies the suction of the h.p. feed pumps. There are two Mather & Platt 100 per cent duty feed pumps for each turbine/boiler unit and each is driven by a 3,140 h.p. 3,000 r.p.m. 3·3 kV motor of the same make. Each pump is capable of delivering 900,000 lb/hr of water through the h.p. heaters and economiser to the boiler, the discharge pressure of the pumps being 1,950 lb/sq in.

Each turbine has a pair of single-effect bled steam evaporators connected in parallel across the de-aerator



General view of turbine room

and No. 2 heater bled steam points, and these are capable of producing boiler make-up water at the total rate of 25,000 lb/hr. The water supply to the evaporators is obtained from shallow wells sunk on the site and is first passed through a completely automatic hydrogen ion/sodium zeolite water treatment plant. Two water treatment plants are installed with a total maximum capacity of 16,900 gal/hr. In addition, a portable demineralisation plant with a capacity of 3,800 gal/hr is available for starting purposes, i.e. the initial filling of the boilers. The water treatment and demineralisation plants were supplied by the Permutit Co., Ltd.

Cooling Water System

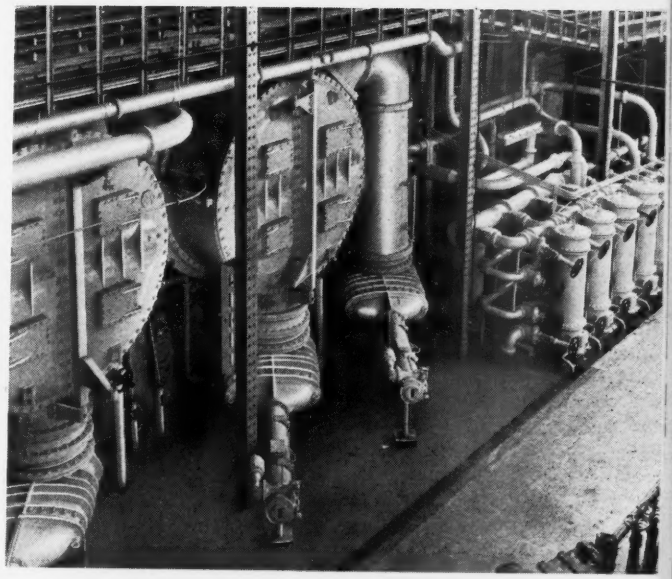
Cooling water for the condensers is obtained from the River Trent, which has a minimum average summer flow of 8·5 million gal/hr and since the total requirements of the station will be 25 million gal/hr four reinforced concrete cooling towers have been erected by Mitchell Construction, Ltd. They are each capable of cooling 4½ million gal/hr through a temperature range of 10 deg F to give a re-cooled water temperature of 71 deg F with a dry bulb temperature of 55 deg F and relative humidity 80 per cent.

Water is drawn from the river by six 70,000 gal/min horizontal-spindle, split-casing river pumps, and after passing through fixed coarse grids and six rotating band fine screens, it is pumped into aqueducts extending the length of the station. After passing through the condensers the water is returned to seal pits whence it can be returned either to the river downstream, or pumped by four 75,000 gal/min horizontal-spindle, split-casing tower pumps through the four cooling towers, the cooled water being returned to the suction side of the river pumps for recirculation. Both the river and tower pumps, which are in a separate concrete pump house, were supplied by Worthington-Simpson, Ltd., and are driven by 1,030 b.h.p. and 1,710 b.h.p. English Electric motors respectively. By manipulation of the appropriate penstocks in the circulating water system either direct cooling by the river, or mixed cooling by the use of the towers, can be employed as dictated by river flow and temperature. Intermittent chlorination of the cooling water, by means of Wallace & Tiernan equipment, is applied at the condensers to prevent slime development. This obviates the need for periodic manual cleaning to maintain optimum vacuum conditions.

Each alternator generates at 13·8 kV and is rated at 100 MW at 0·8 power factor when operating at a hydrogen pressure of 0·5 lb/sq in. The design provides for voltage regulation from 75 per cent of rated voltage on no-load with a leading wattless output of 21 MVA to rated voltage at any load up to 100 MW with a wattless output between 37·5 MVA leading to 75 MVA lagging. The short-circuit ratio based on a rated output and voltage is nominally 0·55 and the sub-transient reactance is not less than 12½ per cent when the generator is short circuiting at half rated voltage. The gear-driven main and pilot exciters run at 1,000 r.p.m. and operate in conjunction with automatic voltage regulators of the amplidyne type. Each machine is fitted with supervisory equipment to provide indication and recordings of the shaft position, eccentricity, differential expansion and speed. The hydrogen cooling system consists of gas control and seal oil equipment situated within and adjacent to the main foundation blocks of the machines.

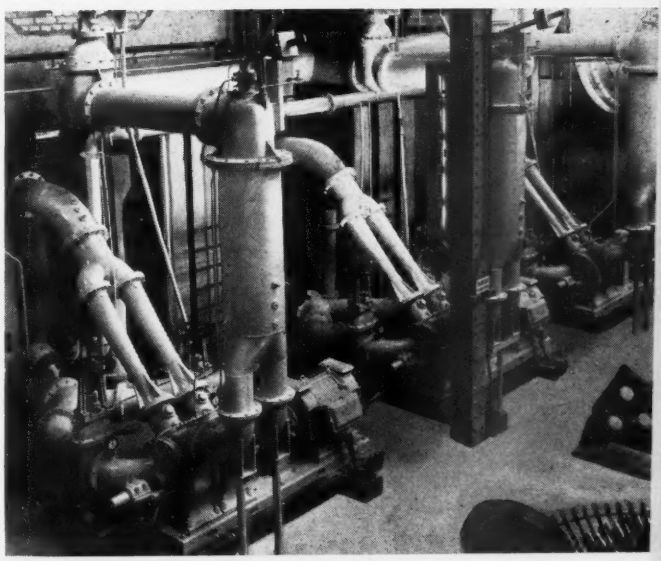
Each pair of turbo-alternator/boiler units is controlled from a central plant control room, which is situated between the turbine hall and boiler house at the common operating floor level. All of the instruments for the automatic control of the boiler, coal pulverising plant and the turbine are situated in this room, together with remote controls for auxiliary motors, turbine supervisory equipment, and alarm systems. Other instruments and controls not required for the constant operation of the sets are placed adjacent to the associated plant items. A comprehensive telecommunication system connects the plant control rooms with operators at different levels in the boiler house, turbine hall, and coal and ash plant houses, as well as providing direct communication with the main control room.

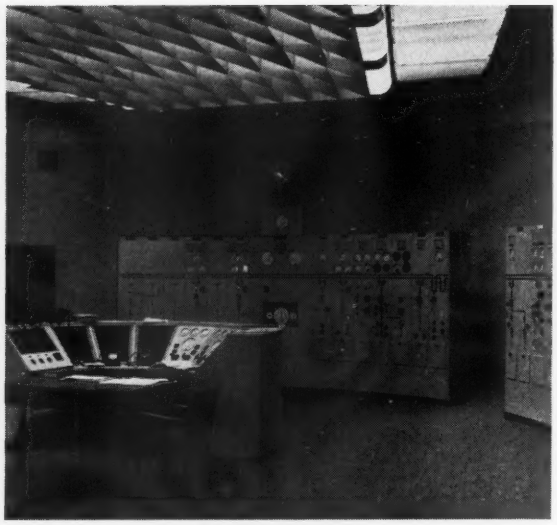
The main control room is in a separate building between the transformer bays, which run along the south wall of the turbine house, and the 132 and 275 kV switch compounds about 100 yd away. In plan it is horseshoe shaped and accommodates miniature control panels fitted



Twin condensers in the turbine room basement showing oil coolers to the right

Three condenser air exhausters serve each machine





Part of the main control room

with mimic diagrams to provide control and indication for the generator transformers and feeder circuits on the 132 and 275 kV main transmission system. The central desk incorporates the necessary controls for regulation of the load and reactive output of the six generators. Switching of the main supplies to the station auxiliaries is also carried out here. Protective relay panels, metering and telecommunication equipment are in separate rooms in the control building.

Alternators Nos. 1 to 3 are connected by 120 MVA 13·8/145 kV generator transformers in outdoor cells to the 132 kV switchgear in the outdoor compound where they are switched and synchronised at 132 kV. Alternators Nos. 4 to 6 will be connected to 106 MVA 13·8/295 kV generator transformers to the 275 kV switchgear and they will be switched and synchronised at this voltage. The 132 and 275 kV switchgear is interconnected by two 120 MVA supergrid transformers. Each generator will have a 10 MVA unit transformer solidly connected to the 13·8 kV windings to supply the essential 3·3 kV auxiliaries. In addition, two station transformers and two starting transformers, all of 10 MVA rating, are provided for supplying the station 3·3 kV system from the 132 kV busbars. For l.v. auxiliaries and lighting, numerous transformers connect the 3·3 kV system to the 415 V switchboards.

The 132 kV outdoor switching station accommodates twenty 3,500 MVA oil circuit-breakers, and the four 132/3·3 kV station/starting transformers. Further switches are used for three bus-couplers, two bus-sections, six feeders and a 90 MVA reactor. The alternator o.c.b.s are equipped with surge divertors. The adjacent 275 kV switch compound will have ten 7,500 MVA o.c.b.s. The 132 kV cables from generator transformers Nos. 1 to 3 to the switch compound are of the oil-filled type, one circuit per phase and 0·6 sq in section. The cables on the l.v. side of the auto-transformers are of a similar type with 0·75 sq in cross-section. No cables are envisaged at 275 kV: generator transformers Nos. 4 to 6 will be connected to the 275 kV switchgear by twin overhead s.c.a. conductors spaced 12in apart.

The design and construction of the station is being carried out by the C.E.A. East Midlands Division with Freeman, Fox & Partners acting as civil engineering consultants. The architects are Clifford, Tee & Gale.

The main contractors are:—Civil engineering work, Taylor Woodrow Construction, Ltd.; boilers, coal and ash handling plant, Babcock & Wilcox, Ltd.; turbo-alternators, condensing and feed heating plant, and transformers, Metropolitan-Vickers Electrical Co., Ltd.; steam, feed and auxiliary pipework, Aiton & Co., Ltd.; cables, British Insulated Callender's Cables, Ltd.; 275, 132 and 3·3 kV switchgear, British Thomson-Houston Co., Ltd.

Acknowledgment is due to Mr. L. F. Jeffrey, Divisional Controller, East Midlands Division, C.E.A., for permission to publish this article, and to Mr. H. Topley, superintendent of Castle Donington, for assistance in the preparation of the material.

British Plastics Convention

TWENTY-TWO of the world's leading authorities on plastics are to address a convention to be held in conjunction with this year's international British Plastics Exhibition at Olympia, London (10th to 20th July). About seventeen papers on various aspects of production and moulding are being presented.

The potentialities of reinforced plastics materials for large structures such as motor car bodies, ship superstructure and railway rolling stock have been recognised for some time, but little progress has been made in these fields because of the lack of reliable design data, inconsistency of material properties and the inadequacy of existing manufacturing methods to produce a consistent product. The purpose of a paper by Mr. W. A. Baker (Bristol Aircraft, Ltd.) is to show how attention to these three matters in the aircraft industry has enabled a number of high performance plastics projects to be put successfully into large-scale production and to point out the basic principles which must be followed if reinforced plastics materials are to achieve their full potentialities in other and wider branches of engineering.

Another paper, by Dr. Ing. Gerhard P. M. Schenkel (Paul Troester Maschinenfabrik), deals with aspects of extrusion in Germany. After giving a short review of traditional and modern raw materials as well as their preparation for extrusion and feeding to the screw, the basic features of modern screw extruders (preferably single screw), dies and ancillary equipment as well as recent applications of such plant are discussed.

Messrs. J. Hofton and C. P. Vale (B.I.P. Chemicals, Ltd.) describe recent developments in arc resistant thermosetting moulding materials. Melamine formaldehyde resins have been known since 1935, but there was little development of moulding compositions based on these resins in this country until after the war. Even then development was confined, except for one type made in small quantities, to cellulose filled materials. Increasing technical demands for high arc resistance and heat resistance in electrical insulation have led to the production of various new mineral filled types. The physical properties of mouldings made from melamine formaldehyde resins reinforced with long and short glass fibres, glass mixed with finely divided mineral fillers in different proportions, and asbestos, using both plasticised and unplasticised resins are discussed.

A paper on developments in extrusion by Mr. A. Kennaway (Imperial Chemical Industries, Ltd.) reviews some recent work, most of it originating in the laboratories of the Plastics Division of I.C.I. Theoretical topics discussed are the influence of granule geometry and feed section design on extruder output and behaviour, the melting of granules and the energy limitations to output, the use of a novel theory of flow, and flow through dies.

Welding Developments

British Commonwealth Welding Conference Papers

VARIED aspects of the fabrication of metal structures are being dealt with at the British Commonwealth Welding Conference (organised by the Institute of Welding) which opened on 18th June under the presidency of Sir Charles Lillicrap. The conference closes to-morrow (Saturday). Several papers have a more directly electrical bearing, among the earliest being one on welding in boilers and power station plant by Mr. T. Carlile and Dr. H. Harris (Babcock & Wilcox). In this reference was made to the higher steam pressures and temperatures (e.g. 1,050 deg F) made feasible through advances in welding technique.

Use of Low-Hydrogen Electrodes

Summarising the present position the authors stated that metal-arc multi-layer welding was extensively employed for all thicknesses of plate, that single-run submerged-arc welding was available for a limited range of thickness and that above these values the multi-layer submerged-arc welding process was frequently adopted. The greatest recent technical development appeared to be that of low-hydrogen (basic-coated) electrodes with a recognition of the adverse effects of hydrogen in welding. With such electrodes, the critical temperature for the end of martensitic transformation was lowered by 70 deg C or more, compared with cellulosic, rutile or oxide-silicate coating. The weld cooling rate to prevent cracking of Mn-Cr-Mo-V steel, for instance, had been increased from about 15 deg C/sec to more than 50 deg C/sec. Without the low-hydrogen electrodes the construction of some items of large modern drums would hardly have been possible, which was the case also with non-destructive radiographic means of weld examination by X-ray equipments of one million or two million volts. Radioactive isotopes and ultrasonic methods might prove even more efficient.

The largest boiler drum now being made in Great Britain was 66ft 6in long by 6ft inside diameter. It was fabricated from $5\frac{1}{8}$in plates having a minimum tensile strength of 38 tons/sq in. The safety-valve and hydraulic-test pressures were 2,750 lb/sq in and 4,125 lb/sq in and the weight before drilling exceeded 110 tons.

Investigations by industrial concerns and by the British Welding Research Association included those relating to reducing the too-conservative factor of safety of 4 when calculating the allowable working stress on the tensile strength of steel. Alternatively, stress could be determined by using a factor based on the Continental 0·2 per cent proof stress at the operating temperature—a value that had been used for British drums exported. An agreed solution was regarded as urgent as affecting the economic utilisation of appropriate low-alloy steels.

The extra cost of all-welded joints between boiler tubes and collector boxes over expanded joints for large boilers was considered to be outweighed by greater boiler availability, due to elimination of leaky joints, particularly with two-shift operation.

All boiler and economiser tubes in the heat exchangers at the Calder Hall and Chapelcross nuclear power stations had elliptical fins of aerofoil section, resistance welded to the tubular heating surface to increase the heat transfer.

For butt welding 1 to 2in bore superheater tubes up to $\frac{3}{8}$in thick, which were operated at temperatures several degrees higher than that of the steam (e.g. 1,050 deg F), oxy-acetylene pressure welding was under consideration as capable of producing consistently welds of high quality. In a modification of this system induction heating had been developed, which also promised marked advantages over flash welding. Manual welding was still found more practicable for small butt welds on some designs of superheater tubes. Jointing between the low-alloy steel headers and the austenitic steels used in the highest temperature section of some modern superheaters caused stresses due to the unequal expansion of the two steels. This had entailed the design of " transition " pieces that had proved successful.

The authors suggested that the use of $2\frac{1}{4}$ per cent Cr, 1 per cent Mo steel should be used only where its creep or stress-rupture qualities justified its considerable disadvantages in production, fabrication and welding as compared with 1 per cent Cr, $\frac{1}{2}$ per cent Mo steel.

The amount of site welding had very greatly increased owing to the larger size of modern boilers. For example, a radiant boiler serving a 100 MW turbo-alternator required 7,500 butt welds in tubes and pipes, varying from $1\frac{1}{16}$in to 10in outside diameter for the boiler, and 700 more for steam and feed piping. As the drum was 123ft above basement level, the furnace tubes were transported to the site in two or three lengths and arc-welded before being lifted into position. Preheating and stress-relieving of joints made by the metal-arc process were effected by electric heating because of its ease of control within fine limits. X-rays were little used in site examination of conventional boilers owing to the bulkiness of the equipment, but the method had been extensively applied to nuclear reactor vessels and heat exchangers. Gamma radiography was also employed for examining pipe butt welds. Magnetic flux technique was being developed, but for wall thicknesses of over 1in it was generally being superseded by ultrasonic processes. The importance of training welding operators was emphasised.

Boilers and Turbines

In his paper on welding in generating stations, Mr. L. C. Dipper (John Thompson Water-Tube Boilers) pointed out that for oil engines and water turbines the main purpose was to provide lighter and more easily manufactured parts, to give greater accuracy of form or to resist corrosion, thus lowering capital costs, improving efficiency and reducing maintenance. For steam stations welding enabled additional and different economies to be achieved mainly in regard to boilers and turbines. The large steam generating plants of to-day, working at very high pressures and temperatures, could probably not be constructed without welding. Their extremely large heating surfaces, involving close-pitched tubes, long tube lengths, and intricate manipulation, could be attained only by the extensive use of shop and site welds, the making of shop welds being greatly facilitated by the almost indispensable automatic flash-butt welder. The ends of high-pressure valves were also prepared for welding to the pipes, considerably saving weight and ensuring sounder joints. Ducting, hoppers and the like

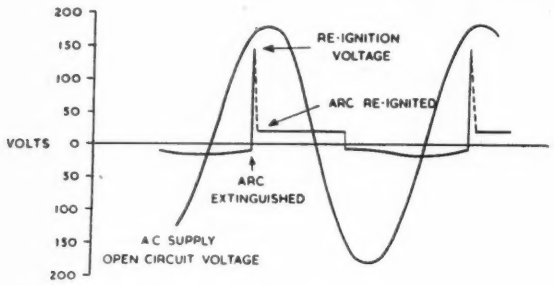
were now also mainly welded, lessening air infiltration and gas leakage, as well as weight, cost, and erection time, there being fewer site joints to make.

Large engine and turbo-alternator frames were now completely fabricated by welding and their main members were often tubular to permit additional cooling. Rotors, bed-plates and bearing pedestals for such machines were now almost exclusively fabricated and, apart from the saving in weight as compared with castings, they provided freedom from blowholes and similar discontinuities, thus improving magnetic qualities. Welded joints in the cooling circuit ducting of hydrogen-cooled alternators were essential to maintain a leakproof system.

Tanks for transformers, switchgear and large oil circuit-breakers were now practically all welded, as were the cooling tube joints to the transformer tanks and radiators. Thick joint flanges in light tanks had been eliminated by machine stud welding, and flanges were now formed integral with the tank plate by bending, thus saving a number of operations as well as material. Metal-clad draw-out switchgear had been greatly improved in design and appearance, as well as showing a great saving in material and cost, by the use of fabricated steel supporting frames. With the advent of the atomic power stations welded construction of a much more complicated type was coming into use.

Developments in power sources for manual and automatic arc welding were described by Mr. H. C. Hebard (Quasi-Arc), who mentioned the growing preference for a.c. equipment, which in this country had reached 80 per cent of the total now sold, mostly oil cooled. Current control for British air-cooled sets was usually by a tapped series reactor. Stepless current control by series saturable reactor (unless incorporating a large amount of iron) distorted the waveform at low currents, resulting in unstable welding conditions. A recent introduction was a variable-leakage transformer having a number of primary windings in different physical relationship with the secondary; current control was by switches which selected appropriate primary combinations. This design used less iron but more copper and was likely to be more costly.

Gas-shielded arc welding using non-consumable electrodes was extensively used for manual operation, especially for welding aluminium. Since the arc was free from intermittent short circuits by molten metal, welding conditions were particularly stable. Moreover, the high open-circuit a.c. voltage was required for only a very short period during each positive half-cycle to secure arc re-ignition (see diagram). Advantage had been taken of this in a surge injector which permitted welding with an open-circuit voltage of 45 to 50 compared with the normal 90 to 100 and virtually eliminated interference with radio and television. At present the magnitude and timing of the injected voltage needed to maintain a stable arc varied with the type of electrode, but means of widening the use of the system were being studied.



Voltage required for arc re-ignition with non-consumable electrode gas-shielded a.c. welding

In d.c. welding the most significant recent development had been the selenium three-phase transformer rectifier, which had a substantially higher efficiency than a d.c. motor-generator; its weight was lower, and it required less maintenance, while being less subject to changes in output voltage with temperature rise. Stepless control of current was obtained on its a.c. input either by a moving-core choke or by a saturable reactor. Rectifiers differed fundamentally from motor-generators in providing almost instantaneous voltage change with load variation. They were more susceptible to variation in mains input voltages, but this drawback could be overcome through magnetic-amplifier control, which furnished a more versatile control of welding conditions than any hitherto.

For automatic welding a.c. was often preferred for 1,000 A or more and for small diameter tubes on account of the elimination of arc blow. It was unsuitable at the high speeds necessary in some recent processes, where the inherent stability of the d.c. arc facilitated automatic control, especially of electrode feed by electronic means.

Recent experiments had shown that by matching the shape of an adjustable rising characteristic of a power source, the arc current could be controlled by variation of electrode-feed speed alone. The open-circuit voltage was preset at the arc length required to maintain the welding current desired over the full range of the power source.

South Wales Institute's Centenary

THE centenary of the South Wales Institute of Engineers will be celebrated on 29th and 30th October next. The programme will include a civic reception and luncheon at the City Hall, Cardiff, on the first day followed by the formal opening of the centenary celebrations at the Institute and the William Menelaus Memorial Lecture to be given by Sir Charles Goodeve (director, British Iron and Steel Research Association) on "The Development of Britain's Physical and Geographical Advantages." Ladies are invited, for whom a visit has been arranged to the Welsh Folk Museum. A conversazione will be held in the evening.

On the second day a visit will be made to the Steel Company of Wales, Ltd., Margam, where luncheon will be taken. In the evening the centenary dinner will be held at the Park Hotel, Cardiff, and will be followed by a dance. Application forms to attend, which are returnable by 27th July, can be obtained from Mr. E. S. Douthwaite, secretary of the Institute, Park Place, Cardiff.

Performance of Rotating Machines

WHEN in 1955 the four principal British Standards for rotating electrical machines (B.S. 168, 169, 225 and 226) were revised and published jointly as B.S. 2613, it was appreciated that this was only an intermediate step pending certain developments affecting rating and temperature rise. In the latest edition of B.S. 2613 the load-with-overload basis of rating has been eliminated and all machines have either continuous ratings or short-time ratings. The other principal change from the previous edition lies in the section dealing with temperature rise where five classes of insulation (A, B, E, F and H) are now specified.

In other sections types of enclosure are classified, preferred horse-powers and speeds are given and the requirements for type and routine tests are specified.

Copies of this Standard can be obtained from the British Standards Institution, 2, Park Street, W.1, price 7s 6d.

VIEWS on the NEWS

By REFLECTOR

AT the Eastbourne Convention it was once again borne in on me how "anonymous" the officials of the nationalised electricity supply have become, with the exception of those in the top positions. In the days of the I.M.E.A. the borough electrical engineers were real potentates and were always given their territorial designations, e.g. "Lamb of Manchester" (who was at this year's Convention) or "Bache of Cheltenham" (whom I missed this year). Now the former chiefs are in other jobs and too often all that is known about them is that they are with one or other of the Boards. This applies even to the district managers who are in some sense the successors of the borough electrical engineers and in most cases have charge of even larger areas. Many others who went over to the generating side are even more hidden under new titles. It would be a great pity if this trend towards "impersonality" continued. Maybe there will be a slow process of recognition as the years go on, if changes are not too frequent.

* * *

A great many of the people on the stands at the Convention Exhibition to whom I spoke appeared to be very sorry about the decision not to have an exhibition at next year's Convention. Some of them recognised the need for giving the electrical display at Brussels in 1958 a clear field but others were not sure that it was essential to do this. Some of them were quite convinced that a few of the manufacturers would stage small shows of their own at Brighton (some already do have their own displays, of course), but besides being wearisome to visitors, and probably more expensive for the firms concerned, they would be an inadequate substitute for the excellent exhibition which E.D.A. organises each year. It is fair to say, however, that some people I talked with were relieved that they would not be called upon to arrange displays at Brighton.

* * *

At a recent gathering Earl de la Warr praised the North Western Electricity Board for its unobtrusive erection of electricity poles and said that it had done a very good job in preserving the beauty of the area. No doubt his Lordship was quite sincere but I recall that he was once Postmaster General and therefore in the pole-erection business himself and may have had a fellow feeling for the Board.

* * *

One of those who took part in the Independent Television programme "People are Talking" last week was Mr. R. Craig Wood, managing director of the Hotpoint Electric Appliance Co., Ltd. Mr. Wood's "talking point" was the importance of the home market *vis-à-vis* export trade on which he has very definite views. He said that he had just come back from a trip round the world and although in general he had found that British goods were competitive, in his own field of domestic electrical appliances he had been dismayed to find that our products were becoming unacceptable to overseas buyers. This, he contended, was because the home market was so hampered by hire-purchase restrictions and purchase tax. I feel this is a point that cannot too often be impressed on the powers that be.

* * *

Writing on the improvement in farming standards, the Agricultural Correspondent of *The Times* says:—

> "Television aerials to receive both kinds of service have sprouted everywhere in the villages and on farms connected to the main supply of electricity. This is a good index of cash to spare. Indeed, television is the consideration that makes many farm families insist on having a house that has mains electricity, and who will blame them?... The more isolated the farm, the more mains electricity is appreciated by the men working there.

Whether the Electricity Boards are as appreciative of this type of consumer is not so certain. The more isolated the farm the greater the cost of supply and lighting and television hardly make for remunerative customers. Perhaps when the television set is paid for, however, there may be cash to spare for electrical appliances.

* * *

I would like to quote the following purple passage from an article in the Aberdeen *Press and Journal*:—

> "No sparks, no shocks—no electricity. I was in the Hydro-Electric Board's steam station in Millburn Street. A giant slept, building up his energy for the five o'clock call. He stripped and went to bed at the eleventh hour. There was no need to stay on. His fellow giants the water stations, took everything in their stride. They, the water giants of the Wild West, fed the city. Mr. Power, of Millburn Street, slept. Well-nourished men greased his joints, took his pulse, studied his charts and pronounced him fit to electrify the city when it stirred again."

* * *

Some strange claims were made in the early patent specifications reported in the columns of the *Electrical Review*. One, listed in the 25th June, 1897, issue, was for a "new or improved construction or arrangement of generator of electricity," and the invention was described in the following cryptic terms:—

> "Relates to an appliance for the generation of electricity without expenditure of heat, mechanical labour, or the application of chemical materials in a purely physical manner as the outcome of terrestrial motive force in the form of two currents. The scope of the invention will best be understood from the claim which is for the application of vacuum chambers consisting of several cells each with a vacuum in a vacuum, and a vacuum over a vacuum for the purpose of effecting the conversion of power (conversion of the natural atmospheric pressure, or, by means of a mouth and suitable contrivances for pressure, of artificially increased air, gas or hydraulic pressure) into electric fluid. 3 claims."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

In our last issue we briefly announced the appointments to the board of Babcock & Wilcox, Ltd., of **Mr. I. Maxwell Stewart,** B.Sc., A.M.I.Mech.E., M.I.N.A., M.I.Mar.E., and **Lord Bridges,** P.C., G.C.B., G.C.V.O., M.C., F.R.S.

Mr. Stewart was educated at Loretto School, the Royal Technical College, Glasgow, and Glasgow University, where he gained a B.Sc. in mechanical engineering. He is chairman and managing director of the Thermotank Engineering Co., Ltd., deputy chairman of Brown Bros. & Co., Ltd., and on the boards of Eagle Star Insurance Co., Ltd., the National Bank of Scotland, Ltd., and Lyle Shipping Co., Ltd.

Lord Bridges

Mr. I. M. Stewart

Lord Bridges was educated at Eton and Magdalen College, Oxford, where he was elected to a Fellowship of All Souls in 1920. His father was the Poet Laureate, Robert Bridges, O.M. After serving throughout most of the 1914-18 war, when he won the Military Cross, he entered the Civil Service in 1920 and joined the Treasury Department. His subsequent distinguished administrative career culminated in his appointment in 1945 as Permanent Secretary to the Treasury and Head of the Civil Service. In 1938, when a Principal Assistant Secretary at the Treasury, he was chosen to be Secretary to the Cabinet, and he served in that capacity throughout the last war. He retired from the Civil Service in the autumn of 1956 and was created a baron in 1957. In February, 1957, he was appointed chairman of the governing board of the National Institute for Research in Nuclear Science.

Mr. T. B. Williams, A.M.I.Mech.E., has been appointed power station superintendent at Bromborough, C.E.A. North West, Merseyside and North Wales Division. He is at present the deputy station superintendent at Clarence Dock where he has been since 1954. Mr. Williams received his early training at Swansea Technical College and Swansea Corporation Electricity Department and from 1936 to 1939 he was technical assistant at Tir John power station. He served with the Eighth Army during the war, attaining the rank of major. In 1946 he returned to Tir John power station and held various positions up to deputy boiler house superintendent. He was appointed boiler house superintendent and operation and efficiency engineer at Percival Lane in 1950 and between 1952 and 1954 held the position of deputy station superintendent there before joining Clarence Dock station in the same capacity.

The Midlands Electricity Board announces the appointment of **Mr. B. K. Watts** as manager of its Ludlow District in succession to the late **Mr. E. S. S. Hennen.**

Mr. Watts has been district engineer at Ludlow since 1948. After some years in Spain and Gibraltar with his family, he resumed his career in the electrical industry in 1937 as head of the Engineering Department of the Kidderminster district of the former Shropshire, Worcestershire and Staffordshire Electric Power Co. In 1941 he moved to the company's North Western Division based on Ludlow, at first as assistant divisional engineer and later as assistant manager. When the M.E.B. was established in 1948 he became engineer of the Ludlow District, and in this capacity he has been responsible for arranging the extensive rural development programme in this large district.

Mr. E. Bates, deputy chief commercial officer of the Eastern Electricity Board, has been appointed to succeed **Mr. W. A. Royle** on his retirement from the position of chief commercial officer of the North Eastern Electricity Board. Mr. Bates entered the supply industry in 1925 with the Ilford Corporation and subsequently served with the County of London Electricity Supply Co., the West Kent Electric Co., the Isle of Thanet Electricity Supply Co., and the Luton Corporation. During the war he spent two years with Messrs. Kennedy & Donkin as assistant electrical engineer on the construction of Ballylumford power station for the Northern Ireland Electricity Board. At vesting date he joined the Eastern Electricity Board where he has been engaged on commercial policy, planning and development. During the period of shortage of generating plant some years ago he took a leading part in the revival of thermal storage space heating by the now familiar "block" heaters, and his work in this connection is described in a paper "Development of Transportable Thermal Storage Space Heaters" which he recently presented to the Institution of Electrical Engineers. Mr. Bates serves on a number of national committees mainly connected with the development of utilisation; these include the E.D.A. Rural Electrification Advisory Committee and Street Lighting Committee. He will take up his duties at Newcastle at the beginning of September.

Mr. E. Bates

Mr. V. Clements, of the Cementation Co., Ltd., left London on 19th June by Air France on a visit to the Middle East and India. He will return to this country on 16th July.

In the list of men who received recognition in the Birthday Honours, published in our last issue, we mentioned **Mr. J. A. Dunkley,** a senior development and experimental engineer with R. B. Pullin & Co., Ltd., and **Mr. F. W. Townsend,** experimental manufacturing manager, aircraft and automotive group, the Plessey Co., Ltd., who were awarded the M.B.E. We have since received their portraits which we reproduce.

Mr. J. A. Dunkley

Mr. F. W. Townsend

On completing sixty years' service with the General Electric Co., Ltd., this month, **Mr. W. T. Massey,** technical adviser on tools at the Witton Works, was presented by the company with a television set. The presentation was made at an informal gathering at the Magnet Club by Mr. J. J. Gracie, director. Congratulatory telegrams included greetings from the chairman, Sir Harry Railing, and vice-chairman, Mr. Leslie Gamage.

Mr. Massey joined the G.E.C. Engineering Works at Manchester in 1897, and in 1902 he left Manchester to help in the installation of equipment at the new engineering works then being built

Mr. W. T. Massey (left) at the presentation ceremony marking his 60 years' service with the G.E.C. On the right is Mr. J. J. Gracie, C.B.E., director, Witton Engineering Works

on the Witton site, Birmingham. In that year he also voluntarily started up an ambulance service at the Works. In the following year he was transferred to the tool room, of which he became foreman in 1911 and superintendent in 1930. He was appointed to his present position of technical adviser on tools in 1951.

In our last issue we recorded the appointment of **Mr. J. W. Moule**, B.Sc., M.I.E.E., as chief commercial officer of the South of Scotland Electricity Board in succession to Mr. J. Gogan, and we now reproduce a recent portrait of Mr. Moule.

Mr. J. W. Moule

In the Power Convention golf competitions held at the Royal Eastbourne Golf Course the winner of the G. P. Dennis Trophy was **Mr. A. W. Ferguson** (Northern Ireland). The Lady Citrine Trophy went to **Mrs. A. H. Young.**

Mr. C. E. Roper has joined Elliott Brothers (London), Ltd., as manager of its Aviation Division. Mr. Roper, who was born in Coventry and is a freeman of that city, was previously with the central management group of the Plessey Company, Ltd., and seconded to the Plessey Development Co., as group production executive. He was responsible for the establishment of the Square D manufacturing facilities in this country. Before joining the Plessey Co., Mr. Roper was sales director and deputy managing director of Hobourn Aero Components, Ltd.

Despite the dull and rather cool weather there was a good attendance at the annual sports and gala of the London establishments of the **General Electric Co., Ltd.,** held at the company's sports ground, Wembley, on Saturday last, and the full programme of thirty-four events was carried out with the expedition and efficiency associated with this meeting. The chief prize, the "Leslie Gamage" trophy (awarded each year to the leading London establishment), was retained by Head Office, with the Union Works a close second. A number of directors attended, including Mr. Leslie Gamage (vice-chairman and joint managing director), who was accompanied by the Hon. Mrs. Leslie Gamage. At the close of the events, Mrs. Gamage presented the prizes. In the evening there was dancing in Hirst Hall.

Mr. W. L. Hamley, who is in his seventieth year, has retired from the service of Britmac Electrical Co., Ltd. (C. H. Parsons, Ltd.), after representing them in South West England and South Wales for twenty years. Altogether Mr. Hamley has been in the electrical industry for fifty-two years; he was at one time associated with Mr. A. F. Berry (British Electric Transformer Co.) in the early days of the cooker industry.

He is succeeded by **Mr. A. K. Newburn,** who is the son of Mr. E. A. Newburn, the manager of the Taunton Sub-Area of the South Western Electricity Board.

Over 6,000 employees and their families attended the first gala day organised by the **Ekco Social and Sports Club** (E. K. Cole, Ltd.), which was held at the Ekco Sports Ground on 15th June. There was a wide variety of entertainments and Mrs. E. K. Cole, wife of the chairman and managing director, made the presentation to the winner of the "Miss Ekco 1957" competition, Miss Margaret Butler (Ekco Service Department). The runner-up was Miss Joyce Farmer.

The North East Electrical Club held its annual golf outing at Ravensworth Golf Club last week. The main event was the 18-hole medal round for the Mullens Trophy. This was won by Mr. T. H. Dellow with a score of 86−18=68 net. Other prizewinners were Messrs. S. C. Clegg, J. Copeland and J. Nicholson.

At the annual meeting of the **Association of Electrical Machinery Trades** held last Monday at the Kensington Palace Hotel, London, Mr. H. Vernon, a director of Thomas Ward, Ltd., was elected chairman for the ensuing year, and Mr. C. Aldridge, sales director of Hirst Electronics, Ltd., was elected vice-president. The meeting was preceded by an informal luncheon when Mr. G. W. Smith expressed on behalf of the members their appreciation for the work during the past year of Mr. A. H. Spindler, the retiring chairman.

Mr. L. A. Fickling, sales manager of Linolite, Ltd., is paying a visit to South Africa and Rhodesia, and will arrive in Cape Town on 11th July. His tour will include Durban, Johannesburg, Bulawayo and Salisbury.

Mr. G. Leslie Dennis retired on 19th June after fifty years in the electrical industry. After periods of service with the Brush Electrical Engineering Co., Ltd., the Loughborough Corporation and West Bromwich Corporation Electricity Departments, H.M. Dockyard, Devonport, and Gloucester Corporation Electricity Department, he was appointed district consumers' engineer with the West Gloucestershire Power Co., Ltd., in 1928. Upon nationalisation of the industry he was appointed commercial officer for the Dean Forest District of the Midlands Electricity Board. His successor is **Mr. K. R. Davey,** who, until recently, was with the Eastern Electricity Board, at Beccles, Suffolk.

Mr. G. L. Dennis

Sir Alexander Sim has been appointed a director of W. T. Henley's Telegraph Works Co., Ltd. Sir Alexander has recently returned from India where he was chairman of Andrew Yule & Co., Ltd., and president of the Associated Chambers of Commerce of India and president of the Bengal Chamber of Commerce and Industry.

At a farewell dinner held recently at the Polygon Hotel, Southampton, **Mr. P. Allen,** late manager of Brown Brothers' Southampton branch, was presented with a television receiver by Mr. K. Comport, a director, on behalf of the company. Mr. Allen, whose

Lord and Lady Mills driving to the British Electrical Power Convention in a 1900 electric brougham

retirement was occasioned by reason of impaired health, was for many years employed at the head office. In 1946 he was appointed manager of the Eastbourne branch and in 1950 took over the managership of the Southampton branch.

Mr. G. H. Parker

We reproduce a portrait of **Mr. G. H. Parker,** Associate I.E.E., whose election as national chairman of the Association of Supervising Electrical Engineers was reported in our last issue.

Mr. Percy Clegg, B.Sc.Tech., M.I.E.E., sub-area engineer, No. 7 Sub-Area, North Western Electricity Board, is retiring at the end of the month. Mr. Clegg was born at Rochdale, Lancs., in 1896 and graduated from Victoria University, Manchester. After training with Mather & Platt, Ltd., he was for a time with Ferranti, Ltd., and then with the Rochdale electricity undertaking. He became engineer and manager at Bingley in 1923 and was subsequently engineer and transport manager at Haslingden, borough electrical engineer and manager of Morecambe and Heysham and engineer and manager at Macclesfield from 1940 until the nationalisation of the supply industry in 1948 when he became sub-area mains engineer, No. 7 Sub-Area; he was appointed sub-area engineer two years ago.

Mr. Clegg's successor is **Mr. Harold Lees Partington,** mains engineer of the Board's No. 4 Sub-Area. Mr. Partington joined Rochdale Corporation in 1916 and served in various capacities with the Manchester Electricity Department, the British Thomson-Houston Co., the Lancashire Electric Power Co., Walsall Corporation and the Stretford & District Electricity Board before being appointed deputy chief engineer to the last authority in 1946. He took up his present position on nationalisation.

Mr. J. P. Wolfenden, M.Sc., M.I.E.E., was recently appointed principal of the Twickenham Technical College. He has been succeeded as head of the Department of Electrical Engineering and Physics, Borough Polytechnic, by **Mr. V. Pereira - Mendoza,** M.Sc. Tech., M.I.E.E.

OBITUARY

Mr. Roland C. Hatton, formerly chief maintenance engineer with the Yorkshire Electric Power Co. and latterly with the Yorkshire Electricity Board, died on 5th June after a short illness, at the age of sixty-nine.

Mr. Hatton went to Yorkshire from Battersea in 1913 as district engineer in the Southern district of the Yorkshire Electric Power Co., a position he held until 1919 when he became responsible for the maintenance of the company's system as a whole. One of the pioneers of overhead transmission in this country, he was joint author, with the late Dr. J. McCombe, of an I.E.E. paper on the maintenance of overhead lines. Since vesting day his activities had been mainly devoted to the training of young engineers and linesmen. Mr. Hatton had served on an E.R.A. Committee dealing with insulating oils.

Mr. Frederick Henry Reeves, whose death we briefly reported in our last issue, had been chief accountant of the Marconi group of companies since 1951. He joined the Accountants' Department of Marconi's Wireless Telegraph Co., Ltd., in 1920, being appointed assistant chief accountant in 1933 and deputy chief accountant and chief works accountant in 1936. Eight years later he became deputy chief accountant of the Marconi International Marine Communication Co., Ltd., and its subsidiary companies.

N.A.L.G.O. Conference

SALARY claims on behalf of administrative, professional, technical and clerical staff in electricity had been held up pending the arbitration award on the engineers' claim, said Mr. L. G. Moser to delegates from the electricity industry at the conference of the National and Local Government Officers' Association last week. To ease the hardship of their members, an interim agreement, averaging 4 per cent, had been reached, and this would be taken into account now that the engineering award was known and their own claim could be pressed again.

The Electricity Bill, said Mr. Moser, who is N.A.L.G.O.'s organising officer for electricity staffs, had threatened the national joint consultative machinery, but all the unions had resisted any attempt to put consultation on a purely area footing. The same threat had not extended to negotiating machinery though some Boards might like it to do so.

Mr. John Pepper, establishment officer of the East Midlands Electricity Board, presided over the conference. In his address he referred to discussions on the future of the Industrial Disputes Tribunal. N.A.L.G.O. had stated that the order was vital to the service conditions activities of the Association. It had been their safeguard against authorities unwilling to apply schemes negotiated through joint machinery. On the subject of national machinery to prepare advice on questions of wage and salary policy, Mr. Pepper doubted whether any criteria could be formulated of universal application throughout industry and the public services.

A motion submitted by the Executive proposed that they should put to the 1958 conference suggested rules to enable a strike policy to be incorporated in N.A.L.G.O.'s constitution; it further proposed that immediate provision should be made for building up a strike fund of £2½ million by a levy on all members. In the event, the motion was not carried, being replaced by an amendment deciding on no further action.

The status of electricity, gas, and other non-local government members of the Association came under discussion on motions designed to give them greater autonomy within the constitution. Separate machinery is provided to determine service conditions matters for each group, but some have felt that local government matters may crowd out other topics at the annual conference. The Suffolk Electricity Branch and the Bolton Group Gas Branch put forward motions to give to the pre-conference meetings of service groups certain rights of voting on motions relating to their own affairs. The Executive Council undertook to examine the matter.

Employers in the A.S.E.E.

The Association of Supervising Electrical Engineers has decided to admit employers to membership. Commenting on this decision the *Electrical Supervisor* (the A.S.E.E. official journal) says that to acquire membership or associate membership an employer will have to provide evidence of his engineering qualifications and background as well as his status in the industry. Others may become associates if they satisfy the Executive Council that they occupy responsible positions in the electrical or allied industries.

Prices of Materials

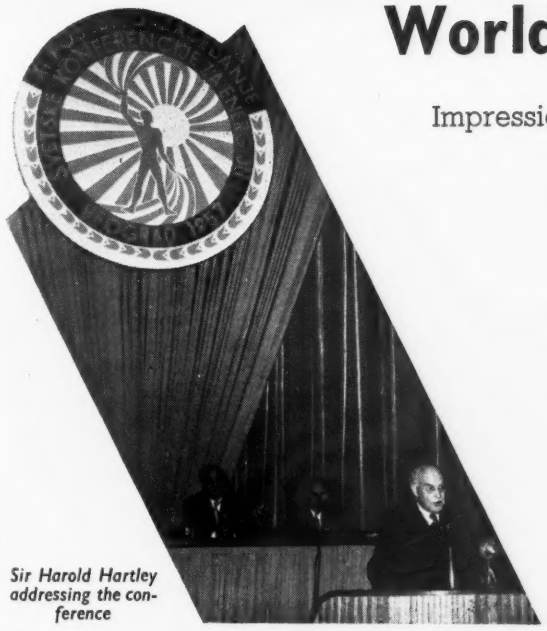
In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton	£197 0s 0d
COPPER, H.C. Electro	ton	£221 10s 0d
Fire Refined 99·70%	ton	£220 0s 0d
Fire Refined 99·50%	ton	£219 0s 0d
COPPER Tubes	lb	2s 1¾d
Sheet	ton	—
H.C. wire and strip	ton	£271 5s 0d
LEAD, English	ton	£89 15s 0d
Foreign	ton	£88 0s 0d
MERCURY	flask	£90 0s 0d
TIN, block (English)	ton	£761 10s 0d
ZINC, G.O.B. Foreign	ton	£72 0s 0d
Electrolytic	ton	—
BRASS Tubes (solid drawn)	lb	1s 9¼d
Sheet	ton	—
Wire	lb	2s 6d
PHOSPHOR BRONZE Wire	lb	3s 10¼d
PLATINUM	oz	£34 0s 0d
RUBBER, No. 1 R.S.S. spot	lb	26¾d—27d

World Power Conference

Impressions of Sectional Meeting in Belgrade

FROM A CORRESPONDENT



Sir Harold Hartley addressing the conference

SOME preliminary particulars of the eleventh sectional meeting of the World Power Conference and of the power resources of Yugoslavia were given in the *Electrical Review* of 31st May.

The conference opened at 10 a.m. on Wednesday, 5th June, in the large hall of the Trades Union Building, a very well-planned and finely-constructed building the inside of which is rather reminiscent of the Festival Hall in London. In his opening speech Mr. Edward Kardelj, vice-president of the Yugoslavia Federal Executive Council, mentioned the great contribution which the World Power Conference had made, for more than 30 years, towards international co-operation in questions concerning energy. He stressed the particular importance of the present session as an effort to narrow the gap between the highly industrialised and the under-developed countries by pointing the way towards the increased use of energy. It was, he said, commonly recognised that the degree of energy consumption had a direct, if not indeed proportional, influence on national prosperity. This made such an international discussion on power, as a factor of development, especially valuable at the present time when there was an obvious awakening, on the part of the under-developed countries, to the benefits that energy could give and when rapid technical progress in new methods of power generation offered such promise for the future. The question was of economic, social and political importance; no matter under what ideology peoples lived, their greatest need was more energy for development.

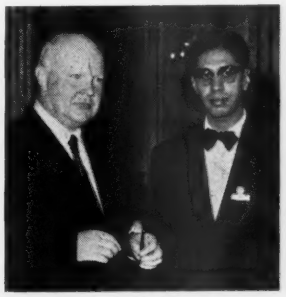
The appearance of the conference hall itself, with over 500 delegates, and their friends, from 51 countries ranging from Indonesia, through India to the United States of America and from Uruguay to Iceland, with representatives of all colours and political creeds, was truly impressive. For the first time a sectional meeting of the World Power Conference was being devoted entirely to a study of the needs of under-developed areas and it was obvious from the opening speeches that the more technically advanced countries were aware of the difficulties facing their less fortunate brethren and of the need to help them by suggesting ways in which their energy problems might be solved.

In the plenary session following the opening, Sir Harold Hartley pointed out that, at past meetings, evidence of increased productivity from the use of energy had come from the highly industrialised countries, but it was for the Belgrade meeting to show how far these findings could be applied to the less developed countries which had not so far been able to take advantage of progress in scientific research. Power was only a means to an end, that end being the most effective utilisation of the indigenous resources of each country. The problems of mechanisation of both industry and agriculture, and the relation of men to the machine, needed careful study; sometimes work could be done better by manual labour than by a machine. Circumstances in each country would decide the question whether the objective should be a rapid transition to the automatic factory, cutting out the intermediate stages through which the older countries had passed, or a fresh stimulus to village industries by provision of power and transport.

Dr. H. J. Bhabha (president, Department of Atomic Energy, India)

The development of industry should be based as far

Left : Sir John and Lady Hacking and Mr. E. R. Wilkinson with other delegates. Right : Dr. V. A. Baum (head of Solar Energy Research Institute, Moscow) and Mr. M. Q. Siddique (Pakistan)



as possible on indigenous raw materials and surveys were needed to evaluate the resources. The transport of fuel over long distances was costly and consequently the possession of adequate energy resources would have a decisive effect on a country's immediate evolution but, in the future, nuclear power should become increasingly available at an economic cost.

Dr. H. J. Bhabha, chairman of the Indian Atomic Energy Commission, stressed that, while adequate power was needed, a balance must be struck when capital resources were limited; there must be enough capital to finance the industries needed to use this power. If hydro power were available from perennially flowing rivers, without involving excessive civil engineering, this was the cheapest power available and it should be developed regardless of other considerations if close to where the power could be used.

Atomic power stations, the capital cost of which was certain to be high, must operate on high load factors for economy and must, therefore, be able to feed their output into a grid. They might therefore have only limited scope in under-developed areas owing to the wide dispersion of the population, although the total load might be larger. Factors determining this scope varied greatly from country to country.

Should Schemes be Self-Supporting?

Conflicting views on the financing of power schemes were expressed by Mr. Walker L. Cisler (president, Detroit Edison Co.), who held that such schemes should always be self-supporting without the need for subsidies, and by Mr. Gunnar Myrdal (executive secretary, Economic Commission for Europe) who stressed that national planning could not rationally be done in terms of costs and profits of individual enterprises. It might be wise to undertake schemes in spite of their not appearing remunerative according to private business calculations.

As the discussions proceeded it became clear that, while the experience of the industrialised countries was of interest to the under-developed areas, the degree of its application was dependent upon the present state of development of an area, upon its physical situation, its climate and other factors. When the present development was not too far behind that in more advanced countries their experience could be applied advantageously—as perhaps in Yugoslavia itself which is on the threshold of industrial development. Where, however, development has hardly begun, or has not begun at all, the problems are so different that this experience may not be very helpful—unless, indeed, the necessary capital were available for a complete scheme of rural electrification. Even then there would be the question of load building and the prospect of a lengthy delay before the inhabitants could afford a high consumption of energy. The use of small local generating stations would seem to be a first step in development in many of the quite extensive areas which could be much more fully developed for agriculture. This has been recognised in the U.S.S.R. which already has large numbers of such stations. It is very expensive to import energy, in not very large quantities, for each district from the nearest large generating stations and the transport of oil for diesel generation is also costly when the distances involved are great and the roads are bad. Failing a small, easily operated, " packaged " nuclear power plant of (say) 10 to 100 kW capacity—which is not likely to be available for many years to come—there is scope for such local energy resources as wind, solar radiation, small scale water power and vegetable wastes.

In the right foreground of this group is Mr. Hong Wong (Central Electricity Board, Federation of Malaya). On his right are Mr. K. W. Finch (Trinidad and Tobago Electricity Commission), Mrs. Wong and Mrs. Finch

As a general conclusion, the conference, well attended and very well organised by the Yugoslav committee, has been most successful. It has ventilated the problems and must have shown some delegates, with experience only in industrialised countries, that the methods used there are not necessarily applicable in under-developed areas whose special problems need consideration along new lines.

One cannot conclude without mentioning the social side of the conference. In addition to the delightful evening receptions given by the Yugoslav Government and by the foreign Embassies, there were exhibitions of folk dancing, boat trips on the Danube, visits to the hydro-electric station at Zvornik and a special performance of *Don Quixote* at the opera house which Marshal Tito and his wife attended. The first part of a permanent home for a Belgrade annual fair was officially opened as an interesting exhibition of the progress being made in electrical manufacturing in Yugoslavia.

As for the city itself, it is distinguished by several quite lovely parks overlooking the Danube, by the very mixed character of its architecture, which might be expected in a city which, in the course of its long history, has changed hands 60 times, and by the scarcity of motor cars. Perhaps the most lasting impression for the delegates will be the friendliness of the people of Yugoslavia who are obviously making the best of their somewhat difficult economic circumstances.

Preparations for the meeting were in the hands of a committee, the chairman of which was Professor Dusan Velickovic (Belgrade University), a vice-president of the Yugoslav National Committee of the W.P.C. The president of the National Committee is Mr. Cedomil Milicavic (director-general, Yugoslav Federal Electricity Board) and the secretary, Mr. Stefan Han.

The annual report of the World Power Conference for 1956 names the principal officers of the International Executive Council as:—President, Mr. Franz Holzinger (Austria); chairman, Sir Vincent de Ferranti (Great Britain); honorary chairman, Sir Harold Hartley (Great Britain); vice-chairmen, Dr. A. J. Alves de Souza and Messrs. Gail A. Hathaway (U.S.A.) and C. Milicavic (Yugoslavia); secretary, Mr. C. H. Gray.

Future Meetings

The next sectional meeting, the report states, is to be held in Montreal from 7th to 11th September, 1958. Its subject will be economic trends in the production, transportation and utilisation of fuel and energy. Probably another sectional meeting will be held in 1960 at a place and date to be arranged. The sixth (plenary) Conference, in Australia in 1962, is likely to take place in October, but the name of the city has not yet been announced.

The statement of accounts of the International Executive Council (Central Office Maintenance Fund) shows the expenditure during the year ended 31st December, 1956 (£4,086) to have exceeded income by £36.

OVERSEAS ELECTRICAL TRADE

SHARP RECOVERY IN EXPORTS IN MAY

THE exports of electrical machinery and apparatus in May showed a welcome recovery after the setback experienced in April. The total of £21 million was an improvement of £3·5 million as compared with April and was up by about £1·5 million on the figure for the corresponding month of 1956. The total exports for the first five months of the current year amounted to £95·1 million, as compared with £90·5 million for the similar period of 1955. The classes which recorded the greatest increases were cables and wires, exports of which rose from £2,799,661 in April to £4,535,325 last month, and telegraph and telephone material which increased from £1,428,119 to £2,158,633.

Exports of generating sets, generators and motors totalled £2,866,360, a rise of about £250,000, and there were small increases in exports of converting machinery and radio and television equipment.

In the generating sets, generators, etc., group, India

TABLE I.—ELECTRICAL EXPORTS

Class	Month ended 31st May 1957	Five months ended 31st May 1956	Five months ended 31st May 1957
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	159,579	664,466	769,171
Ditto, 10 to 65 kW	220,069	596,738	855,739
Ditto, 65 to 200 kW	151,975	751,954	558,786
Ditto, over 200 kW	352,176	1,397,192	1,350,492
Spark ignition engine driven	27,785	198,817	80,548
Steam turbine driven	22,115	155,033	255,246
Hydraulic turbine driven	—	145,529	—
Other prime mover driven	43,562	323,462	158,083
Generators, not exceeding 200 kW	174,315	642,112	784,558
Ditto, over 200 kW	111,141	433,876	410,815
Parts of generators	257,396	2,942,595	1,971,158
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p.	205,694	1,047,490	1,006,357
Over ½ but under 1 h.p.	42,410	305,552	238,370
1 h.p. to 250 h.p.	488,266	2,160,074	2,500,146
Over 250 h.p.	90,824	350,975	534,137
Railway, tramway and trolley-bus motors complete and parts of all motors	210,295	849,157	902,887
Motor starting and controlling gear	308,758	1,205,871	1,623,709
	2,866,360	14,170,893	14,000,202
Converting machinery	21,344	151,734	353,171
Mercury-arc rectifiers	120,241	314,806	325,504
Transformers for lighting, heating and power (incl. coils):			
Not exceeding 7,500 kVA	750,748	5,558,091	3,305,199
Over 7,500 kVA	94,013		927,893
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	303,467	1,319,080	1,591,537
Ditto, other	1,208,169	5,862,932	5,730,926
	2,497,982	13,206,643	12,234,230
Primary batteries:			
Lighting	120,861	404,070	517,070
Radio	273,436	1,204,942	1,373,644
Other	32,096	214,007	209,848
Parts (excl. carbons)	64,908	193,123	273,990
Lamps:			
Filament, exceeding 28 V*	111,802	506,061	459,069
Ditto, under 28 V*	26,356	147,295	158,756
Arc lamps and searchlights	12,815	99,371	70,627
Discharge lamps, fluorescent tubes, etc.	76,243	344,439	480,190
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury arc rectifiers), photo-electric cells, stabilising and cold cathode valves, magnetrons, klystrons	17,431	136,479	121,806
All other	312,692	1,026,411	1,439,253
Parts (excluding glass bulbs)	18,020	62,840	61,669
Radio and television transmitters	22,328	302,280	263,037
Commercial radio and radar equipment	1,213,527	5,940,441	6,275,639
Domestic radio receivers, mains	93,292	741,005	579,920
Ditto, battery	70,725	399,564	305,090
Ditto, other (incl. car)	38,666	120,034	137,431
Radiograms	20,476	191,387	133,445
Television sets	63,021	227,362	303,930
Public address equipment	90,290	460,979	480,478
Other radio and television apparatus, n.e.s.	30,204	164,923	247,232
Components and parts, n.e.s.	802,867	3,267,089	3,939,419
	2,793,539	13,040,794	14,288,349
Telegraph and telephone installations	862,675	3,209,394	3,383,838
Telephone instruments, separately consigned	98,929	613,694	780,445
Telegraph and telephone parts	904,713	2,900,955	4,142,192
Line apparatus for long distance commun.	292,316	818,479	654,936
	2,158,633	7,542,522	8,961,411

Class	Month ended 31st May 1957	Five months ended 31st May 1956	Five months ended 31st May 1957
	£	£	£
Cookers	69,255	420,461	332,378
Toasters	15,908	107,647	89,681
Other cooking apparatus	29,883	178,815	157,349
Parts and accessories	68,796	433,134	359,888
Space heating appliances	28,066	229,683	177,370
Water heating appliances	38,296	171,445	166,451
Other heating appliances	29,341	205,815	205,963
Parts and accessories	55,701	315,373	306,903
Irons	78,182	518,233	340,505
Arc welding equipment, a.c.	41,514	276,495	286,055
Ditto, d.c.	67,914	227,892	265,862
Resistance welding equipment	13,585	111,053	111,014
Electric furnace plant	80,748	287,801	472,513
Magnetos, ignition	31,646	133,988	163,430
Sparking plugs	179,699	788,304	807,134
Elec. appliances for aeroplanes, n.e.s.	306,712	1,019,780	1,376,066
Ditto, for motor vehicles, n.e.s.	362,001	1,792,184	1,804,680
Ditto, for cycles, n.e.s.	64,279	375,940	297,447
Signalling app. (incl. traffic signals)	129,508	308,872	576,667
Instruments, commercial	161,386	894,221	926,687
House service meters (including parts)	119,679	890,904	781,945
Electro-medical apparatus (not X-ray)	87,401	184,174	214,550
X-ray apparatus (excl. tubes and valves)	111,224	332,120	365,115
Vacuum tubes	68,833	129,467	239,313
Ceiling fans, complete	125,183	537,057	591,062
Desk fans, complete and parts of desk and ceiling fans	36,271	162,514	177,860
Vacuum cleaners	190,439	657,898	785,959
Floor polishers	82,184	409,119	428,478
Food mixers	35,962	325,405	232,271
Hair clippers and dry shavers	104,512	365,683	432,978
Other portable appliances	26,643	161,092	144,026
Parts	148,360	592,619	660,165
Portable elec. tools (not saws) and parts	224,934	1,034,719	1,105,426
Cables and wires:			
Telegraph and telephone, submarine	1,458,158	1,310,885	1,642,442
Ditto, other	1,120,906	4,215,538	4,977,267
Cotton, silk or art. silk insulated	40,253	311,673	199,107
Enamel, glass or asbestos insulated	91,811	455,976	500,620
Paper insulated	798,363	4,819,810	4,266,737
Rubber insulated	611,785	2,531,962	2,858,847
Thermoplastic insulated	218,351	684,353	866,085
Other	195,698	1,175,853	966,461
	4,535,325	15,506,050	16,277,566
Accumulators for motor vehicles	166,082	878,965	761,658
Ditto, traction	25,614	113,351	146,745
Ditto, radio and other portable	80,735	427,897	417,929
Ditto, other	30,555	268,857	163,709
Parts and accessories	73,639	427,056	413,998
Elec. porcelain, etc. (incl. insulators), n.e.s.	106,641	535,395	556,325
Insulating cloth and tape	59,645	303,336	311,371
Other insulating material	92,195	476,401	464,182
Permanent magnets	52,223	228,036	234,653
Radio, telegraph and telephone testing equipment, n.e.s.	85,843	198,475	340,869
Scientific elec. instruments (not telegraphic or telephonic):			
Time recorders and time switches, complete	11,697	64,227	62,822
Other	337,150	992,047	1,516,887
Electrical machinery, n.e.s.	92,631	570,123	363,385
Electrical apparatus and appliances, n.e.s.	1,032,304	3,906,266	4,678,270
TOTAL	21,031,355	90,550,549	95,120,946

* The figures for 1957 are not completely comparable with those for previous years.

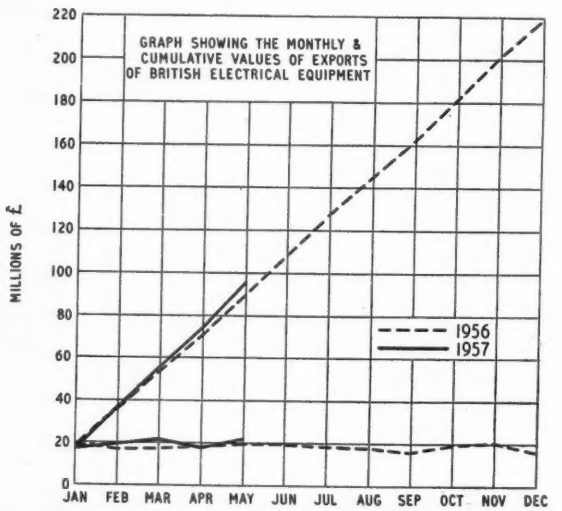
TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	May 1957	Five months ended May 1956	Five months ended May 1957
	£	£	£
Channel Islands	63,462	383,482	439,785
Gibraltar	12,489	208,145	61,243
Malta and Gozo	68,017	334,917	312,644
Cyprus	161,898	763,503	665,702
Sierra Leone	48,231	124,910	172,848
Gold Coast	264,605	708,910	936,926
Nigeria	356,812	1,430,981	1,453,899
Union of South Africa	1,454,208	6,761,912	7,336,497
Rhodesia and Nyasaland	429,656	2,693,203	2,458,689
Tanganyika	82,017	290,152	311,799
Kenya	309,577	1,169,476	1,330,521
Uganda	113,945	363,532	568,271
Mauritius	40,793	135,240	183,929
Aden	36,600	268,507	253,284
Bahrain, Qatar and Trucial States	171 774	472,722	746,121
Kuwait	277,161	590,146	1,271,626
India	2,171,385	8,820,195	10,478,142
Pakistan	268,722	1,289,339	1,471,779
Singapore	310,763	1,457,724	1,714,195
Federation of Malaya	348,684	1,330,836	1,554,758
Ceylon	120,578	771,500	697,898
British North Borneo	27,747	131,930	115,593
Sarawak	67,297	98,855	127,702
Hong Kong	209,268	966,885	1,116,116
Australia	1,622,946	9,227,447	8,099,661
New Zealand	948,171	4,651,375	4,633,657
Fiji	17,594	83,643	98,548
Canada	1,001,976	5,309,594	5,240,031
Jamaica	127,091	579,347	468,805
Barbados	17,884	138,821	96,169
Trinidad	132,823	569,030	620,255
British Guiana	43,168	202,320	212,074
Other Commonwealth countries	85,255	449,348	527,516
Irish Republic	224,399	1,477,635	1,105,180
Soviet Union	231,331	1,316,952	839,265
Finland	247,913	686,630	627,792
Sweden	415,399	1,497,555	1,821,221
Norway	184,119	1,029,729	1,010,613
Iceland	60,579	68,513	91,952
Denmark	197,683	857,518	1,047,078
Poland	62,585	138,400	195,071
Western Germany	260,266	875,953	1,085,961
Netherlands	731,916	2,922,808	3,515,216
Belgium	383,833	1,367,731	1,681,330
France	422,976	1,571,569	1,929,027
Switzerland	151,607	482,842	610,098
Portugal	230,440	927,749	1,282,997
Spain	170,542	1,478,132	1,825,174
Italy	375,567	1,536,722	1,603,537
Austria	47,512	202,558	173,572
Yugoslavia	16,238	298,160	247,158
Greece	38,227	1,034,189	645,984
Turkey	27,645	380,991	234,297
Belgian Congo	44,787	159,017	232,838
Portuguese East Africa	40,254	125,631	153,134
Egypt	971	879,917	1,824
Libya	39,505	106,670	189,088
Southern Morocco	12,756	215,968	183,010
Sudan	149,861	442,826	480,667
Syria	45,843	302,026	184,674
Lebanon	41,978	258,417	176,882
Israel	127,029	396,978	379,748
Jordan	78,253	257,621	373,993
Saudi Arabia	120,510	377,568	285,193
Iraq	277,898	1,669,960	1,267,128
Iran	538,291	899,359	1,791,548
Burma	52,237	696,886	339,264
Thailand	113,088	535,816	481,675
Indonesia	69,154	257,192	271,039
Japan	95,698	296,118	405,179
United States of America	2,102,593	4,216,946	5,046,269
Cuba	51,711	158,449	213,048
Mexico	50,508	327,511	263,531
Columbia	54,656	454,296	232,903
Venezuela	279,999	1,493,905	1,465,608
Peru	33,739	222,246	306,492
Chile	27,074	126,856	218,577
Brazil	145,304	1,150,527	463,630
Uruguay	14,566	54,345	102,070
Argentine Republic	96,234	353,299	468,767
Other foreign countries	433,484	1,183,936	1,793,961
TOTAL	21,031,355	90,550,549	95,120,946

held its position as the most important market with purchases valued at £424,293, other important markets being Australia which took plant valued at £248,041 and South Africa with purchases of £241,821. India was also the best market for converting machinery, mercury-arc rectifiers, etc., with a value of £515,279, Australia with imports of £300,012 and South Africa with £282,062 holding second and third places respectively.

Australia was the principal market for radio and associated equipment, with imports totalling £222,473. Outside the Commonwealth, the Netherlands purchased equipment valued at £207,019 and Italy made purchases valued at £150,185.

The most important market for telegraph and telephone apparatus was Australia, which imported material valued at £272,718, followed by New Zealand with imports totalling £213,693. The United States was responsible for the jump in exports of wires and cables, taking material valued at £1,708,186, India holding second place with imports of £663,754.



The value of the various classes of electrical goods exported is given in Table I, and in Table II their destination is shown.

Other electrical items not shown in Table I, but included in the Board of Trade returns, are:—

Electrically operated washing machines, complete, not exceeding 150 lb net weight: May, £295,559; five months, £1,559,278. Ditto, 150-250 lb net weight: May, £111,621; five months, £537,499. Parts: May, £71,541; five months, £301,654.

Electric carbons, including parts: May, £57,580; five months, £276,732.

Welding electrodes (excluding carbon), covered: May, £136,718; five months, £618,632.

Electric conduit tubes and cased tubes: May, £70,318; five months, £422,819.

Electric locomotives: May, £524,822; five months, £1,999,455. I.c. engines with electrical transmission: May, £146,337; five months, £471,399.

Electrical Imports

There was a small increase in the imports of electrical machinery and apparatus, as compared with April, the total for May of £2,430,145 comparing with £2,382,905 for April. The total for the first five months of the current year was £10,840,252, as compared with £9,860,297 for January-May, 1956. The principal supplying countries were the United States (£806,443), Western Germany (£485,445), and the Netherlands (£380,530). Radio and associated equipment continued to be the principal class of imports.

British Electrical Power Convention

DISCUSSIONS AT TECHNICAL SESSIONS

AT the Tuesday afternoon session of the British Electrical Power Convention at Eastbourne last week there was a joint discussion on the papers "Coal- and Oil-Fired Power Stations," by F. H. S. Brown and E. S. Booth, "The Contribution of the Boiler-Making Industry to the Economic Development of Electrical Power Generation," by W. F. Simonson, and "The Contribution of the Turbo-Alternator Manufacturers," by L. S. Robson. These were summarised in our last issue.

The discussion was opened by Mr. A. S. Dodds (John Thompson) who said it was clear from Mr. Simonson's paper that so far as thermal plant was concerned the boiler-making industry faced a contracting market as regards commercial scope. Two or three years ago a boiler-making company might base its programme on six or eight similar units of 60 MW size, and any leeway lost on the first units could be recovered on subsequent ones, but the present market, which called for a very small number of very large units, was much more exacting.

The advent of nuclear plants was compelling the boiler-making industry to take a major jump forward and to make forecasts of many kinds which an examination of the current construction programme showed to have been accurate and which had enabled the industry to meet its construction dates. With the accelerating tempo of thermal plant design he felt sure that at a Convention before 1960 they would be discussing supercritical pressure plant as an accepted, routine design, and with the more exacting control necessary with such units the operational flexibility provided by dry ash extraction firing should be very welcome to the operating staff.

Mr. A. R. Cooper (C.E.A.), dealing with Mr. Robson's paper, said the designer inevitably thought of successful commissioning as the end of an era, as the culmination of five years of intensive research, whereas to the operator it was the beginning of an era of 25 years of possibly hard labour. With larger and larger machines the incremental gain due to size became less and less. In going from 60 to 120 MW the thermal gain was about 10 per cent, but in going from 275 to 550 MW it was

Tuesday afternoon session (papers on "Generation"). Left to right: Messrs. F. H. S. Brown, W. F. Simonson and L. S. Robson

less than 1 per cent, and the question arose whether any gain in thermal efficiency might not be more than offset by a reduction in availability. He felt that in this country we designed for optimum efficiency and took a chance on availability, while the Russians seemed to design for high availability and took a chance on efficiency. Probably the right answer lay somewhere in between. More research was required into causes of failure. There was no intrinsic merit in having a machine which had to be built to limits of a few thousandths of an inch if the same performance, or something like it, could be obtained by a limit of one-sixteenth of an inch. There was a case for seeing how much would be lost by making designs very much coarser in some respects.

There was also a case not for imitating the Russians but for trying to improve on what they had done in the field of push-button starting. The Russians were conducting intensive research into methods of push-button starting a complicated turbo-alternator set. The ideal should be the push-button starting of the biggest machines by comparatively unskilled operators, with control equipment to shut things down if trouble approached. A desirable starting performance for 120 MW machines would be from zero to full load in 30 min.

The erection of these large machines required more attention. It did not follow that because a machine had been well designed it would be well erected, and he knew of one instance of a 60 MW machine being shut down for nearly twelve months merely because an erector failed to tighten up properly one setscrew on a gas baffle.

Mr. W. W. Campbell (Merz & McLellan) referred to the design philosophy which lay behind the choice of the size of a set, and mentioned in this connection Fig. 1 in the paper by Brown and Booth, in which a typical curve of capital cost per kW against unit size showed several discontinuities or jumps. He thought that this matter should be examined in some detail, because the discontinuities were not all of the same kind.

In the case of a generator he agreed that a point would be reached at which a combination of permissible stress and permissible temperature rise would set a fairly definite limit for any given design, and it would be necessary, in order to go further, to make some radical change, such as going to a cross-compound arrangement, at greater expenditure. That might be called a discontinuity of the first order. The case of the boiler furnace, on the other hand, was different, and the single furnace could be taken a considerable way beyond what was conventionally regarded as the limit, but at considerable extra expense. At a certain point it would become as expensive as two furnaces, and then a change would be made to two-furnace design. That was a second order discontinuity, not a jump but a bump. There were other factors to be taken into consideration, so that a detailed study was necessary to find out the effects of discontinuities of various kinds. It might be found that for certain applications there would be justification for sizes of machine in between the large steps fixed on the basis of present knowledge.

Size of Generating Units

Mr. T. Smeaton (Babcock & Wilcox) emphasised the enormous increase in the size of steam generators which had taken place. While 100 MW straight steam cycle units had been in operation since 1956, the first 120 MW reheat cycle units would commence operation in 1958, the 200 MW units in the following year, and the 550 MW units by 1963. This meant that the size of unit was being increased before the commissioning of, or at any rate before extended operating experience with, the smaller unit. This was an expression of confidence in the design capacity of the industry and the accumulated experience of the Authority, and it surpassed anything attempted anywhere else in the world. It meant that this country in this field was leaving the United States behind.

In the burning of low-grade coal, however, their Continental colleagues had gone further than they had, and this raised the question of the disposal of the ash in the combustion chamber. Slagging furnaces of various types had been developed on the Continent, and particularly in Germany, and some had shown themselves to be very promising in operation at low loads, which was usually one of the difficulties; the load could go down to 30 per cent without the freezing of the slag at the outlet. These boilers had functioned as dry ash furnaces at even lower loads, the ash in the hopper melting again when the furnace load increased. One difficulty in this country would be the very wide range of ash fusion temperatures in the fuels which had to be burned, but he would like to see a trial of different designs of slagging furnace in areas where suitable coal could be assured.

Mr. R. L. Batley (C.E.A. Midlands Division), referring to the difficulty of obtaining new sites, mentioned by Brown and Booth, suggested that it would be necessary to look again at the existing sites with a view to their redevelopment or extension. Commenting on the arguments for the development of the 550 MW set he said that while appreciating its value for window display purposes to encourage exports he was inclined to doubt its value to the industry. Research in the nuclear field was progressing so rapidly that already the nuclear power station programme had been trebled, and even further developments might have taken place before the 550 MW units were installed. They would take the form of two 275 MW units side by side and so would make no significant contribution to saving in space or building costs. Being of the cross-compound type they would be less flexible in operation than two separate 275 MW sets. The gain in thermal efficiency would admittedly be small, and he thought the saving in capital cost per kW was likely to be marginal. The operating loss occasioned by a 550 MW unit being out of commission, as compared with a 275 MW unit, would soon outweigh those marginal savings.

On the question of availability, the arguments put forward postulated the reliability of the 275 kV grid. Little experience was available of this high-voltage equipment, and there had also been little experience of the large units; there had been only 18 months' experience with 60 MW units. He felt that operational experience and design should keep in step, with design a few paces ahead. From Brown and Booth's paper operators would feel that the designer had got so far ahead on the road to progress as to be already round the bend.

Mr. G. F. Kennedy (Kennedy & Donkin), referring to Fig. 1 in Brown and Booth's paper, suggested that it might be preferable, in undertaking new developments, to limit the capital expenditure involved in them by starting at the beginning of the jump instead of at the end. It might be desirable to gain a good deal of operational knowledge of these units before being committed to too high a capital expenditure. In that connection it was of interest that the first supercritical set in the U.S.A. had been of only 150 MW capacity, whereas sets of 200 MW and over had been in operation in that country at lower initial steam conditions.

While with the programme which had to be faced in this country it was necessary to plan a long way ahead, he wondered whether the objective should not be to reduce the commissioning period for a large station, from the time of starting on the site, to three years. He also suggested that the evolution of nuclear energy, and the advantages to be gained by running nuclear plant at as high an annual load factor as possible, made it attractive to consider the development of new plant specifically designed for peak-load operation. The important factors for such plant would be quick starting up and shutting down and minimum capital cost per kW. High thermal efficiency would not be necessary. Such plant might well be installed on the sites of existing power stations as and when present plant became obsolete, and might be combined with district heating schemes with thermal storage. It should also be worth considering all forms of projects for energy storage, which would help to maintain a high load factor for high capital cost plant while providing cheap kilowatts for peak load power.

Dr. H. G. Taylor (E.R.A.), commenting on Mr. Robson's statement that the early publication of a new steam table and chart extending at least up to 1,200 deg F was a matter of urgency, said that the work which Professor Lewitt was doing under the ægis of the E.R.A. was well in hand, and it was hoped that the answer required by Mr. Robson would be available in time for the international conference on this subject next summer.

Six papers on transmission and distribution were discussed on Wednesday morning. Left to right: Messrs. W. Casson, C. H. Flurscheim, E. C. Rippon, J. Henderson, J. S. Cliff and Sebastian Z. de Ferranti

Mr. Booth, Mr. Simonson and Mr. Robson replied briefly to the discussion. Mr. Booth mentioned that the capital saving with the 275 MW machine was expected to be £2/kW compared with the 200 MW unit, and there should be a marginal increase in thermal efficiency. With the 550 MW unit there should be a further £1/kW reduction in capital cost on the score of the rotating plant alone, and a further increase of about 0·5 per cent in thermal efficiency.

A vote of thanks to the authors was proposed by Sir John Hacking.

Transmission and Distribution

At the Wednesday morning session there was a joint discussion on six papers dealing with transmission and distribution. Mr. T. W. Wilcox (Merz & McLellan) commented on Mr. Flurscheim's paper and said that no other country had produced such a comprehensive range of h.v. switchgear, all of it backed by testing methods which were very much in advance of those used in other countries. Almost every h.v. circuit-breaker was subjected to a minimum of sixty tests, and the total number of tests often ran into many hundreds or even thousands, and was very much in excess of anything required by any national or international specification. It was appropriate to ask whether all this testing was really necessary. The most useful employment for a test plant was on development work, and tests for purely certification purposes should be kept to the minimum. Although a great deal of attention was being paid to this, he was not hopeful that much reduction could be made in the number of tests per circuit-breaker. He felt that the commercial value of the tremendous amount of testing which was done was not being properly exploited abroad. Representatives of switchgear manufacturers overseas should fully understand the significance of all the tests carried out, should be familiar with the national and international specifications and should be able to interpret the complicated oscillograph records obtained on test plants.

Mr. J. A. Prescott (E.E.C.), who also dealt with Mr. Flurscheim's paper, said that this explained why British breakers differed in cost and design from those used on the Continent, but with the possibility of European unity in trading the future for the British manufacturing industry was not reassuring, since British designs were geared to a totally different set of standards. For example, British breakers could deal with r.r.r.v. values twice as high as the system required, whereas Continental standards called for only one-fifth to one-tenth of those used here. The effect of this was that Britain was the only country using 300 lb/sq in normal working pressure for h.v. air-blast breakers; in the U.S.A., Canada, Switzerland, Germany and France the figure was 225 lb/sq in and this affected the size and duty of every component, and therefore the cost.

Customers in Canada, South Africa, Australia and, to some extent, the U.S.A., had been specifying values and methods of measurement of radio interference. If the C.E.A. and the Post Office contemplated laying down such standards they should be closely linked with overseas standards and methods.

Mr. D. P. Sayers (C.E.A.) agreed with Mr. Rippon that co-operation between user and manufacturer had played a substantial part in the technological developments described in Mr. Rippon's paper. The use of the digital computer allowed a design to be produced which precisely fitted the purchaser's specification, and it now rested with the purchaser to make equally sure that the specification precisely fitted the service requirements with a margin of safety which was adequate, but not more than adequate.

On the question of insulation levels, under modern system conditions the magnitude of internally-generated surges might be comparable with that of lightning surges. This subject had received a great deal of attention in the U.S.A., where the practice seemed to differ fundamentally from that adopted here. American engineers preferred to use lightning arrestors to limit the over-voltages and reduce the insulation, rather than to accept the over-voltages and increase the insulation accordingly.

On the problem of transport and its effect on the size of future transformers, Mr. Sayers suggested that transformer manufacturers would be dragging their feet a little if they allowed the size of transformers to be limited by transport considerations. A good deal had been said the previous day about the economies of size with generating plant, and this applied also to transformers, so that there was good reason to keep the size of transformers in line with developments in other directions. In Russia transformer tanks were delivered in sections and welded on site, and cores and windings were transported in light gas-filled tanks. Assembly on site seemed the only method unless it were accepted that the size of plant must be dictated by transport considerations.

Peirson and Henderson showed that services accounted for 25 per cent of the total capital cost of a modern distribution system, and the C.E.A. report for 1955-56 recorded an average cost of £26 per consumer. This was much too high and a real effort should be made to find cheaper methods. With underground services labour represented half the cost, and a properly applied system of incentives should enable this to be substantially reduced. The authors referred to the probability that plastic insulation would replace the metallic sheathing and armouring of l.v. power cables. Progress in this

direction in this country was painfully slow; the cable manufacturers had not been enterprising and the mains engineers were very conservative in their approach.

Mr. L. H. Fuller (S.E. Electricity Board), dealing with Mr. de Ferranti's paper on distribution transformers, agreed with the author that Specification T.1 had had a progressive effect on the design of these transformers and suggested that it had been the most important factor in the production of the present excellent and economic transformers. The stocking of certain standard transformers had proved of benefit to manufacturers and users alike. While the development of aluminium transformer windings was academically interesting, he thought the use of aluminium could be justified only by a world-wide shortage of copper. A better use of aluminium in the electrical field was for cables and overhead lines. He was sorry to see that the author did not regard noise as important at present; in his view it was already important and would be better dealt with by steps being taken by the manufacturers to reduce the noise level rather than by the adoption by the user of local palliatives. The three targets for the distribution transformer designer should be (i) the maintenance of the present simplification; (ii) iron loss reduction; and (iii) noise-level reduction.

Mr. H. Willott Taylor (Southern Electricity Board) gave some details of experiments which they had made with single-phase, single-wire earth-return h.v. lines, such as had been used in Australia and New Zealand, to see whether they could be used in this country in spite of the very different conditions here. In Australia a 1/1 transformer had been interposed on the 11 kV or 12 kV system, but it had been desired to avoid that here. Discussions had therefore been held with the Post Office engineers, who had been most co-operative, and tests had shown that very little interference was caused. The fact that they had carried out only four or five schemes was evidence of the difficulty of finding suitable sites. The reduction in cost obtained depended on the local circumstances. The fact that there was only one conductor, and not two in parallel which might clash in a high wind, made it possible to consider span lengths of 800-900ft instead of 350-400ft, which helped with wayleaves, and absence of trouble from wind-blown branches of trees and so on made it possible to run the line only 20ft from a row of tall trees. He would be inclined to say that while extensive use of such lines was unlikely there might be cases where their use would enable isolated premises to be given a supply where this could not be done economically with the present standard methods.

Mr. Geoffrey Kennedy (Kennedy & Donkin), dealing with the paper by Lane and Casson, said the load to be transmitted still remained the basic consideration in selecting the transmission voltage. A h.v. heavy conductor line was the most economic when fully loaded but could be an expensive burden in its early years while the load was growing. On the other hand, public opposition to additional line routes had been increasing and would justify a policy of installing lines of a higher voltage and having larger conductors than were immediately necessary. He believed the Authority had decided not to build further 275 kV lines with small conductors, and he fully supported this policy, taking the view that all these lines should be suitable for operation at 380 kV. The need for 380 kV operation was much nearer than was commonly supposed.

On the question of h.v. d.c., 320 miles had been mentioned as the distance above which d.c. might be more economic than a.c. for overhead transmission. From studies of their own they concluded that where standby capacity had to be provided the high cost of terminal equipment for the standby circuits on a d.c. system reacted unfavourably on the economics of d.c. and that the minimum distance would be 400-500 miles, so that in this country d.c. would be used in special cases only. If, however, it became necessary to deal with major transmission underground, d.c. would come into its own.

Mr. Peter Rochs (Austin Crompton Parkinson Electric Vehicles) emphasised the importance of the electric vehicle to the nation's economy. These vehicles consumed annually 205 million kWh, representing an income of £856,000, and it was clearly in the interest of Area Boards by example and precept to stimulate their use. He mentioned that in Coventry the street gas lighting was serviced by a battery-driven tower wagon.

All the authors briefly replied. Mr. S. de Ferranti said that there were fifty or sixty manufacturers of small transformers who supplied the various Area Boards. Every year about half-a-dozen went bankrupt and six new ones appeared. He suggested that the Area Boards should make up their minds who their suppliers were going to be and limit the number, so that those chosen could produce a proper job at a proper price. The various suggestions for reducing noise in transformers, and so on, were all expensive and had to be paid for somehow.

Nuclear Power

On Wednesday afternoon the discussion on the paper by Duckworth and Pilling, "Nuclear Energy in Great Britain," was opened by Mr. H. West (Metropolitan-Vickers), who said that in his opinion the four consortia had done the country a great service by placing so many of their trained staff so freely at the service of the new programme. There was criticism of the channelling of the work into what were thought of as narrow groups, but the programme was such that it should be possible to spread the load of work throughout those parts of the industry which were normally associated with the building of power stations. To develop the export business it would be necessary not only to satisfy the present nuclear programme in this country but in the same period to deal with a programme of export building which might fall not far short of a figure of 2,000 MW.

To achieve a steady decrease in capital charges and fuel costs would require an intense programme of research and development on the part of British industry, and the four consortia were already spending considerable sums of their own money on this. The four groups had achieved a great deal in collaboration, under the guidance of the U.K.A.E.A., in basic research and investigation, while maintaining intense competition on engineering design. This must be of great advantage to this country and had no parallel at the moment anywhere else in the world.

Mr. R. Vaughan (C. A. Parsons & Co.) thought that the capital costs of the first five years' programme were

Wednesday afternoon was devoted to a paper on "Nuclear Energy in Great Britain." Left to right: Messrs. J. C. Duckworth and W. H. C. Pilling

conservative. The figure of £177 million for the initial fuel charges made no allowance for the substantial increases in fuel rating which could reasonably be expected. It would appear that the chief difficulty lay in finding sites for more nuclear stations. There were already one or more manufacturing groups who would be willing and able to commission another 400-500 MW of nuclear plant by the end of 1961 if given access to another site in the near future.

Mr. E. M. Price (English Electric Co.), dealing with the relationship between the cost of power and the load factor of the plant, suggested that the cost of electricity might be reduced by about 7½ per cent by increasing the load factor to about 85 per cent, which would be within the limits of station availability. This would make the cost of power from nuclear stations of the Calder Hall type competitive with that of coal-fired stations. New coal-fired stations would need new mining facilities to provide the fuel, and this should be taken into account in a comparison of capital costs. In the case of nuclear stations using enriched uranium the expensive treatment plants required for the fuel would raise the capital cost substantially, and he did not think that such stations would have a place in the programme as early as the authors suggested. The first development might well be a combination of stations of the Calder Hall type with hydro-electric pumped storage schemes. If the capital cost of a nuclear station was amortised on the basis of a 75 per cent load factor, the added power necessary for a pumped storage scheme could be costed simply on the fuel and operating charges, which would be very low.

Mr. R. N. Millar (G.E.C.) agreed with Mr. Price that the total investment in new conventional power plant included the new mining facilities and coal preparation plant required, and added the new rolling stock or other means of transporting the coal. While it was difficult to assess the cost of these subsidiary capital investments, he would put it at £55/kW for mining plant and £25/kW for transport. If all these factors were taken into consideration, he suggested that the present annual cost of the nuclear power programme was not very different from the total annual cost of an equivalent thermal power programme, and with the present trend in costs might become much lower.

The authors pointed out that if nuclear power plant was to remain competitive in the early 1970s it would have to be able to generate power at lower load factors than 75 per cent. That requirement was well appreciated by industry and every effort was being made to increase the flexibility of operation of future nuclear power stations and reduce their generation costs. The estimated base-load requirement in 1970 of 9,000 MW seemed rather low, and on the basis of figures given elsewhere by Mr. Duckworth might well be nearer 12,000 MW. If, by this date, preferential tariffs for off-peak domestic loads had been introduced, mainly for water and space heating, the base-load requirement might be substantially higher.

Mr. Geoffrey Kennedy (Kennedy & Donkin) commented on the authors' statement that the total cost of the combined nuclear and conventional plant programme up to 1965 would be £1,460 million, as compared with £810 million if the programme was for conventional plant alone. If the figure of £1,460 included the first charge of fuel in the nuclear stations, the saving of the coal which would be burnt if conventional stations had been provided would have to be taken into account, and that might amount to £150 million by 1965.

The difficulty of finding sufficient suitable sites for reactor stations emphasised the importance of laying out such plant so that at the end of the expected life of the reactor the site need not be abandoned for power purposes. He saw no inherent difficulty in operating reactor plant at load factors of 85-90 per cent. It followed that in the detailed design great attention should be paid to the reliability of all the auxiliary plant.

Mr. J. M. Hallett studies the "Electrical Review" illuminated guide to the stands which was a feature of the Convention Exhibition

Mr. A. A. Fulton (North of Scotland Hydro-Electric Board) said that as a result of the consideration given by the two Scottish Boards to the possibilities of pumped storage it appeared that a certain way to achieve a substantial saving in capital cost and greater flexibility would be the installation of pumped storage at appropriate points in the nuclear programme. Plans had been prepared for a 400 MW scheme in the south-west part of the Highlands, with 275 kV transmission to Glasgow, to be brought into service in 1964-65. The prospects of developing very large pumped storage schemes after that date and combining them with nuclear generation were good. There were potential pumped storage schemes which were estimated to cost, with the transmission, only £48/kW and would give a saving in capital expenditure, compared with an equivalent capacity of nuclear plant, of about £140 million, together with a saving in overall annual costs.

Mr. A. C. Thirtle (C.E.A., South Western Division) emphasised the importance of reliability and said that even in these days they often introduced an advanced design of conventional plant which proved reliable, but then found that the elementary principles of mechanical engineering had been forgotten and something went wrong with a gland.

Mr. J. C. Duckworth, who replied briefly to the discussion, mentioned that visitors from abroad who came to Calder Hall had been very impressed. In nuclear power development there was plenty of room for several good design teams of the type which the consortia had available. The consortia themselves recognised, however, that there were numbers of other firms, so that the balancing of the work to see that everyone had a reasonable share was something that the Authority had to have in mind.

Industrial Utilisation

The discussion on Thursday morning's three papers dealing with the industrial utilisation of electricity was opened by Mr. A. E. Simpson (Guest Keen Nettlefolds).

Dealing with the paper by Sir Henry Clay and Mr. Ovens he said that on multi-stage automatic machines linear motion was achieved by air cylinders much more cheaply and efficiently than by solenoids and relays. If an operation or motion could be achieved direct, this was to be favoured even if it involved a slightly higher energy cost. The cost of the various sources of energy was not the only consideration; reliability was the fundamental factor.

High-grade energy was often used where alternative sources could well be employed. For every three tons of orthodox solid fuel delivered to the power station only one appeared on the consumers' supply lines in its converted state, and for many processes within a factory a very much higher conversion factor was possible. On the subject of thermal storage for space heating, where there was steam or high-pressure hot water generated from solid fuel by a modern boiler plant there was no case from a thermal point of view for the use of electricity for floor-warming of offices and workshops. On the basis of heat release electricity was rather more than twice the cost of coal converted in terms of energy to steam.

Mr. J. I. Bernard (E.D.A.) referred to the campaign conducted by the E.D.A. under the general slogan of " Electricity for Productivity " and pointed out that it was no use telling the industrialist to use more electricity; it was necessary to interest him in new processes, machines or methods of control which would increase output, reduce labour costs or in other ways lead to better results. The achievement of higher industrial productivity was a combined operation, and the E.D.O. was anxious to co-operate and was in fact co-operating, by the production of books and films and in many other ways, in the development of productivity, which was vital for the continued prosperity of our people.

Thursday morning's papers dealt with industrial utilisation. Left to right: Mr. C. T. Melling, Sir Henry Clay, Messrs. G. Ovens and H. S. Wathes

Dr. E. H. Norgrove (George Ellison, Ltd.) drew attention to the preparation of codes of practice for maintenance. One had been almost completed for switchgear and another was in preparation for motor control gear. The deciding factor on whether maintenance should be done by the factory itself or a contractor should be called in was supervision. If a factory could provide adequate supervision then there was something to be said for it looking after its own maintenance.

Colonel S. J. Emerson (Chief Electrical Inspector of Factories) emphasised the fact that in spite of the enormous use of electricity in industry there were not more than 700 to 800 serious accidents a year, of which about 5 per cent were fatal. Electricity was not nearly so dangerous as many of the other forms of power. A plant which was safe to maintain was also, as a rule, cheap to maintain, since maintenance and even emergency repairs could be carried out without special precautions or unnecessary stoppages.

Mr. T. G. Blayney (E. Midlands E.B.) said that while publicity was given to the growth of electrification he felt that the part played by the contracting industry tended to be overlooked. Sales of electricity were increasing by about 6,000 million units a year and the maximum load on the power stations was rising by more than 1,600 MW a year, but this increasing amount of energy could be available where the consumer wanted to use it in the form desired only if the electrical contractor provided adequate installations. This meant that the electrical contracting industry of this country must in a single year provide something like the equivalent of the whole of the installations at present existing in the supply area of the average Area Board. The role of the contractor went much further than the provision of installation to the customers' orders; the nature of his work enabled him to study the requirements and techniques of the industries he served and to suggest the introduction of electrical methods where these would benefit his clients.

Mr. N. G. H. Thomas (Monsanto Chemicals), commenting on the paper by Sir Henry Clay and Mr. Ovens, said that a synthetic fluid was naturally more expensive than a mineral oil, but the act of synthesis provided an opportunity to overcome some of the shortcomings of a mineral oil. The chemical, electrical and thermal stability of the chlorinated coolants was well known and their fire-resistance enabled the transformer to take its rightful place among the plant it served without introducing new hazards. It was an advantage to be able to place distribution transformers where they were wanted. Free from the menace of fire, other problems could be viewed in a new light and things could be done which the limitations of the old materials had prevented in the past.

Mr. J. F. Smith (S. Wales E.B.) said that Area Boards should provide not only for firm off-peak supplies, the off-peak periods being defined in the contract, but for permissive off-peak supplies, because there were many occasions during so-called peak hours when a consumer could be permitted to carry on a certain process. For certain processes the normal off-peak hours might not be sufficient, but normal off-peak hours plus a large number of permissive hours might well justify the expense to the industrial consumer of using some process.

Mr. J. E. Price (Lancashire Dynamo & Crypto Co.), suggested that there must be hundreds of firms who did not realise that the advice of consulting engineers could save them man-hours, electricity and coal. There were still many blatant examples of waste where considerable savings were possible.

Mr. E. M. Fisher (N. Eastern E.B.) agreed with the value of industrial power engineers employed by electricity supply authorities. Such engineers for industrial and mining work had been employed in his area for many years, and the results in the increased use of electricity had fully justified this policy. The supply authorities had a duty to help industry to achieve greater production, and the best way in which they could help was to decrease the relative cost of electricity, to assist in its application and to ensure its economic use. It was essential for the consumer to get value from his expenditure; to have electrical processes

discarded due to bad application or uneconomic use was bad publicity for electricity.

Mr. R. F. Richardson (C.E.A.) said that the Utilisation Research Committee of the C.E.A. and the Area Boards had begun to co-ordinate and arrange for the conduct of research on technical and commercial problems relating to the use of electricity, including the development of new methods of use. Care would be taken to avoid duplication of effort and the fullest use would be made of the staffs of Area Boards and if necessary of individual manufacturers. In many ways the Area Boards were well placed for "trying it out on the dog," and it was hoped that the project would meet the need which existed for the practical testing of new techniques and the publishing of the results.

The authors briefly replied.

Houses into Homes

At the sixth session, on Thursday afternoon, there was a discussion on three papers on the domestic use of electricity, under the title "Houses into Homes," which were followed by demonstrations of good and bad lighting in the home by Mr. W. J. Jones, director of the Electric Lamp Industry Council.

Miss Mary George, director of the E.A.W., in presenting her paper on "The Housewife's Point of View," emphasised the need for an exchange of views between the architect and builder on the one hand and the housewife on the other; it was no use manufacturers producing labour-saving appliances if there was no room for them in "the house that Jack built"—or that some jackass built. A high standard of good and simple design had been achieved for domestic apparatus, but care must be taken not to make its operation too complicated; automatic controls should save mental as well as physical energy.

While a pale pink refrigerator was very attractive, it might make it difficult for the housewife later to change the colour scheme of her kitchen. The ideal would be a surface finish which could be re-coated without much expense. The housewife was faced with a different range of colours and tones for each article she bought, and, to avoid clashing, the paint manufacturers and makers of domestic equipment and fabrics should try to work to some kind of pattern for colours and colour tones.

Mr. R. Craig Wood (Hotpoint) said that Britain, while leading the world in research and development in the generation of electric power and its use in industry, was one of the most backward of civilised countries in bringing the benefits of electricity into the home. This was due not to lack of interest on the part of the housewife or of ability on the part of the manufacturers and supply authorities, but to the crippling restrictions imposed by the Government in the form of purchase tax and consumer credit and hire-purchase restrictions. In a recent trip round the world he had found that British domestic appliances were becoming unacceptable in many foreign markets because, with the home market strangled by Government restrictions, it was uneconomic for British manufacturers to invest large sums in advanced design and development and in the high degree of mechanisation necessary for the efficient production of new appliances. Western Germany, with much the same population as this country and a lower income per head, sold two or three times as many refrigerators and washing machines in the home market as we did, and was thus able to offer in world markets appliances which were more attractive and cheaper than ours.

Mrs. C. Renton-Taylor (Yorkshire Electricity Board) said that consumers who wanted a good installation must be given the necessary information and have almost unlimited perseverance. Talks should be arranged for prospective house owners showing the different lighting schemes which could be adopted, and their cost, and emphasising the advantages of having their home well equipped for the use of electricity.

Mr. I. M. E. Aitken (A.C.E.), dealing with Mr. Davies's paper on wiring, pointed out that there must be a transition period before the new universal 13 A socket-outlet became the rule rather than the exception and expressed surprise that Mr. Davies seemed to abhor the use of adaptors and to make no provision for their use in his proposals. The new fused 13 A adaptor, providing three outlets from one, was inherently safe and altogether different from the usual non-fused "Christmas tree" type. It was to be hoped that the E.D.A. were reviewing all possible means of encouraging, if not enforcing, the adoption of the new universal 13 A socket-outlet on a suitable scale in all new homes, and also in offices and factories.

Mrs. K. Pocklington (Hotpoint) pointed out that most domestic electrical appliances were designed by men for the use of women, and there were many ways in which the advice of the housecraft advisers could be most helpful. A beautiful streamlined iron, for example, lost its appeal if the handle was not the right shape for the user to hold comfortably. Every woman needed to be reminded frequently of the advantages which electricity could offer in the smooth running of her home. Even to-day many housewives looked on a refrigerator merely as a means of keeping the milk and butter cool on a hot day, and home freezers were still almost unknown in this country, though in rural areas far from a shopping centre they could be a great blessing.

It was interesting to find that Miss George coupled the value of standardisation with the importance of choice. While standardisation was necessary for the socket-outlet and the boiling plates on electric cookers, it was essential to give the housewife a variety of appliances from which to make a choice; there must be no attempt to standardise *her*. It was important to see that fuse-boxes and socket-outlets were in accessible places, so that it was not necessary to climb a ladder or crawl on hands and knees to disconnect a water heater or replace a fuse.

Mr. T. Whittaker (British Refrigeration Association)

On Thursday afternoon there were three papers on the domestic use of electricity followed by a demonstration of good and bad lighting. Left to right: Messrs. E. J. Davies, V. W. Dale, Miss Mary George and Mr. W. J. Jones

said that emphasis had been rightly placed on adequate wiring to permit the fullest use of electrical appliances in the home, but it was equally necessary that enough space should be provided in the home for such appliances to be installed. Some of them were bulky and their use might be hindered in the future by lack of space. It might seem a hopeless task to improve the interior design of houses, but since 1946 more than 2,300,000 new houses had been built, so that the housing situation was fluid and there was some hope of getting something done to improve the general average of design. Builders and architects seemed to be out of touch with some of the realities of living to-day. They no longer ignored private motoring and usually provided accommodation for a car, but they still ignored the equally important domestic development in the number, size and variety of electrical appliances which could do so much to improve living standards. The electrical industry would do well to clarify and concert its views on this subject and consider, for instance, whether the propaganda in favour of what was called the ideal kitchen had not made the good kitchen seem unattainable. Having clarified its views, it should then try to impress them on architects and local authorities.

Mr. E. J. Davies, replying to the discussion, said he felt sure that manufacturers generally would welcome any help which the E.A.W. could give. He did not condemn adaptors, the use of which had been made necessary by the lack of socket-outlets, but they created a danger, however well they might be made, if insufficiency of socket-outlets caused the use of long trailing flexibles for people to trip over or for furniture to be wheeled over, leading to bare wires and the risk of fire.

Mrs. M. Forrest (South Western Electricity Board), in proposing a vote of thanks to the authors, suggested that the help of the outside representatives of Electricity Boards should be enlisted in the campaign to educate the public. They were in close contact with consumers and could stir their imagination and make them realise the advantages of an adequate installation.

Electrical Forum

For the "Electrical Forum," held on the last day of the Convention, at which questions were answered *ex tempore* by leaders of the industry, the panel consisted of Lord Citrine, Sir Henry Clay (McLellan & Partners), Mr. T. E. Daniel (chairman, North Western Electricity Board), Mr. J. O. Knowles (chairman, B.E.A.M.A.), Colonel B. H. Leeson (director, B.E.A.M.A.), and Mr. J. S. Pickles (chairman, South of Scotland Electricity Board), with the President acting as question-master.

The first question was how generating stations and transmission lines could be made to harmonise with the landscape, and to this Lord Citrine replied that the decision regarding each station and each transmission line should be taken having regard to its setting rather than on general principles. The Authority were engaging landscape artists and architects to help to fit the new nuclear stations into the landscape, and were doing this more and more with conventional stations also, but there was a good deal of disagreement about what harmonised and what did not. Sir Henry Clay pointed to the problem which would arise when the seaboard was fringed with nuclear stations which had to be fitted in with the bathing beaches, and Mr. Knowles looked forward to the time when transmission lines would become part of the landscape. For power stations, he said, they wanted neither cathedrals nor South Bank Festival Halls, but outdoor stations which were well designed and well balanced; proportion mattered much more than façade. Mr. Daniel was optimistic enough to believe that in time it would be recognised that a power station could be as beautiful as an old cathedral, and Colonel Leeson, taking much the same view, pointed out that the utilitarian things of to-day would in time become the historic treasures of the past, and there would be societies for the preservation of ancient power stations.

Helping Exports

Asked for suggestions on how the nationalised industries could help British exports, Colonel Leeson pointed out that the supply authorities had given and were giving immense help already by allowing British manufacturers to show foreign customers the actual plant in operation and enabling them to meet the engineers who operated it, and also by the help which they gave to supply undertakings abroad, who found visits here, and visits to them by representatives of our supply authorities, of immense value. Help was given in many other ways, and so long as the present spirit of willing co-operation continued the question would be answered by practical deeds. Lord Citrine added that they exchanged personnel with a number of countries, the main obstacle there being the difficulty of getting English people to study foreign languages. Many countries with little experience sent people to the C.E.A. and the Area Boards for training, and at the moment they had about 170 people from countries in which it was most important that Britain's trade should be extended. Mr. Knowles took advantage of the opportunity to plead for support for British participation in the Brussels Exhibition next year.

Off-Peak Tariffs

A questioner wanted to know why Boards which offered off-peak supplies for only a short period sometimes charged more than Boards which offered them over a longer period. Mr. Daniel emphasised that the load curve varied from one Board to another, and the commercial staffs of Boards seemed to have different ideas. Each Board was autonomous, and any attempt to bring them all into line would be fraught with difficulty. Mr. Pickles, on the other hand, said that as all the Boards in England bought on the same bulk tariff there seemed no reason for any great variations in their off-peak tariffs. Some Area Boards published their off-peak tariffs, but others worked by special arrangements. In his view, Boards ought to co-ordinate their off-peak tariffs and certainly ought to publish them. They could not develop off-peak load unless their goods were in the shop window and their tariff published and available to every consumer. With the development of nuclear stations off-peak load would become of even greater importance, and there might be graded tariffs for graded periods. Up to last year his area had had 56,000 kW of off-peak load, and in 1956 alone had added 36,000 kW.

Lord Citrine said there was a question of principle involved. Was there justification for differences in the charges made by Area Boards? It was not possible to reply to the specific question which had been asked without knowing the specific cases, but on general principles,

The panel at the Electrical Forum : Messrs. T. E. Daniel and J. S. Pickles, Lord Citrine, Sir Josiah Eccles, Sir Henry Clay, Col. B. H. Leeson and Mr. J. O. Knowles

if the Boards were to have autonomy, it must be expected that there would be differences in charges, as in other matters. The C.E.A. tried to get the maximum of uniformity among Boards by voluntary methods. Any change would mean compulsory co-ordination; and, while he believed that there was a case for it, and that some of the differences were illogical, while the Boards possessed autonomy they must be allowed to exercise it, with the corrective of the local Consultative Councils if they went too far wrong.

Sir Henry Clay said that differences in off-peak periods often made it difficult to decide on putting in special plant for use in such periods, because the periods tended to be altered without notice and it was very difficult to arrange long-term agreements. He had recently looked into the possibility of putting down some plant in this country and in Germany in which electricity was the main cost of production and there was a possibility of using off-peak supply, and he had found big variations between Boards. Two Boards offered tariffs which were competitive with Germany. If there was the possibility of longer-term agreements it would make the position very much easier. The President closed the discussion by remarking that coal, which was the main element in the running charge of an electricity undertaking, was dearer in Eastbourne than in Nottingham, and the character of the load in Manchester was very different from that in Bournemouth.

Technical Education

On the question of whether present proposals for technical education were satisfactory, and whether industry was making the best use of its technical manpower, Mr. Knowles thought that the answer in each case was " Yes." The steps taken with regard to technical education would increase our competitive power. Industry was alive to the need to use technologists, technicians and craftsmen to the limit of their respective abilities, and in the matter of technical education the electrical manufacturing industry led the other industries of the country. Lord Citrine said that the supply industry was engaging in a great deal of technical education, and 37,000 of their people had taken education and training courses in the last nine years. A great deal more ought to be done, but in giving everyone a chance to take some course someone had to carry on with the work, and a balance had to be struck between the various factors which made for an efficient and prosperous industry. He was confident that in British industry generally the standard of education and training to-day was vastly higher than ever before. Mr. Daniel suggested that it would not be possible to say whether the present proposals for technical education were satisfactory until the results of the new colleges of technology were known. If the best use was to be made of technically qualified men they must be relieved of the burden of paper work which now fell upon them, and it had been his policy to see that such work was done by clerical rather than technical types. Colonel Leeson said that the question of education could not be divorced from training; in parallel with academic education must go practical training in works, and this involved the difficulty of finding sufficient people to pass on the know-how to the coming generation. In the electrical manufacturing industry, over the last seven years there had been an intake of 50,000 people a year, all of whom required training of some kind. Marvellous things had been done to train people for an industry which had grown at a greater rate than any other.

Pumped Storage

Mr. Pickles, replying to a question on the possibilities of pumped storage in this country, said they were both great and important, particularly as, with the development of nuclear plant, in ten years' time it might be approaching a position where it would be in excess of the night load. By installing less nuclear plant but more pumped storage there would be a substantial saving in capital cost; for nuclear stations the figure was about £150/kW, including fuel, but there were pumped storage schemes which could be developed for less than £50/kW. The two Scottish Boards had reached the tentative conclusion to include in their 1964-65 programme schemes to develop 400 MW. Scotland could absorb this, and it would be a matter for investigation whether further amounts could be used in England. Lord Citrine said that the C.E.A. were undertaking a substantial scheme at Blaenau Ffestiniog which might be worked in conjunction with a nuclear power station which it was hoped to build on the coast not far away. His general impression was that in England and Wales the potentialities were not considerable, but investigation was needed which should cover the whole country. If what appeared to be great potential resources in the North of Scotland were to be exploited it would raise serious transmission problems. Mr. Knowles suggested that in this nuclear age other forms of " pumped storage " might become possible, such things as oxy-hydrogen cells. It would first be necessary to find, however, how much could be done by conventional pump storage. Mr. Daniel took the view that pumped storage was just as important with coal-fired as with nuclear stations, but Mr. Pickles disagreed, on the ground that the running costs of the latter would be much less than those of the former.

Lord Citrine, on the question of whether an industry

could make satisfactory progress without advertising, said that it could, but it had been a great handicap to the supply industry in the last few years that, because of parliamentary reluctance to see the nationalised industries displaying their wares in the advertisement columns, public misconceptions had arisen which could have been removed, as well as a great deal of public goodwill created, if the supply industry had gone in for advertising in the way that any large commercial concern would have done.

Rate of Increase in Output

To the question of whether it was reasonable to suppose that the output of electricity would be doubled every ten years, Lord Citrine replied that all the evidence suggested that that would happen. It had not happened merely in this country; it was a world-wide phenomenon, and that was very significant. After ten years' experience, Lord Citrine felt that he could repeat the words used by Mr. Pickles at the last meeting of the I.M.E.A.: "There are no foreseeable limits to the use of electricity." Mr. Pickles agreed, and pointed out that in the United States and Canada, where the consumption of electricity per head was already twice what it was in this country, their engineers expected that it would double in the next ten years. Colonel Leeson suggested that when the time approached when the rate would be slower it would be so evident that there would be no difficulty in discerning it, so that the thing to do was to go ahead.

Lord Citrine, dealing with the effect of a Channel Tunnel on the proposed single cable power link with France, said he confidently expected the Channel Tunnel to be built, but by the time it was finished the capital costs of the cable might have been written off. They could go forward with advantage with the d.c. cable whenever the Governments of the two countries gave the green light, which he hoped would happen in the next few months.

Finally, to the question of whether manufacturing industry could meet the nuclear power programme and still maintain a satisfactory level of exports, Colonel Leeson had no hesitation in giving an affirmative answer. They had always planned for this, he said, and must do it; this country depended on the electrical manufacturing industry to export roughly one-third of what it produced. The only limiting factor was steel, but he hoped that steel production capacity would keep in step with the requirements. Mr. Knowles agreed, and said that the difficulty might be more to get the exports than to do the work. Lord Citrine said they had based their plans on the assumption that manufacturers could meet their programme without any damage to the export trade.

Convention Dinner

The annual dinner of the Convention was held at the Grand Hotel, Eastbourne, on Thursday, 20th June, Sir Josiah Eccles, the president, occupying the chair. The principal guest was the Rt. Hon. Lord Mills, Minister of Power, who, in proposing the toast of "The Electrical Industry," emphasised the interdependence of the different sections of the industry and the fact that electrical power was an urgent need of everyone to-day. The countries in which the greatest amount of electrical power was put at the disposal of the individual, he said, were the countries with the highest standards of life. The United States had built its enormous industrial development on the basis of electrical power, and in this country the need for electrical power was growing fast and since 1948 had doubled. Electricity took the toil out of labour and the drudgery out of housework.

In the short period in which he had been associated with the electrical manufacturing industry he had felt the magnetism which it exerted. To take part in it was an enormous adventure; it had expanded amazingly and its future development would be even greater. So far as the supply industry was concerned, he was impressed by the wonderful job done by the C.E.A., which had brought together a large number of varied units—some efficient, some not so efficient—and welded them into a great national service. The country owed very much to everyone connected with it, and in particular to Lord Citrine and to Sir Josiah Eccles for their leadership.

It had not been an easy task; there had been obstruction by those who liked obstruction for its own sake, from those who valued amenity above everything else and from those who delighted in the exciting sport of baiting our nationalised industries. In spite of this the supply industry had done a wonderful job in providing the power which the country needed.

The C.E.A. had shown great courage in going forward with a new nuclear power programme which held great promise for the country as a whole. Our first industrial revolution had been based on cheap and abundant power, and the second industrial revolution, which was coming, would be based also on cheap and abundant power, provided with the help of nuclear energy.

The President, who responded, said that recently, when subjecting some would-be apprentices to a general knowledge test, one of them was asked "Who is Lord Mills?" to which the reply came back promptly "Lord Mills is the owner of the largest circus in the world." "On the off-chance that the boy might have been right," the President added, "we accepted him for further training." Lord Mills had held many offices of great responsibility, and in his present position as Minister of Power he had a responsibility second only to that of the Prime Minister for the industrial welfare of this country.

The electrical industry was only about seventy years old, and during the first half of that period its growth had been slow, so that one might be pardoned for expressing a sense of achievement in contemplating the continuous pageant of the past few decades. Even in 1920 it was supplying the British people with only about the same amount of electricity as was now used to drive the auxiliaries in the power stations. Since then the growth had been phenomenal and the amount supplied was now sixteen times what it had been in 1920. The achievements of the manufacturers were there for all the world to see—the transatlantic telephone cable, mostly of British design and construction; the latest and largest submarine power cable, between British Columbia and Vancouver Island, wholly of British construction; and the 200 MW and 275 MW turbo-alternators for the C.E.A., were but samples of their products. The export of electrical goods from this country exceeded £272 million in 1956, which was an "all-time high," the increase over the previous year being greater in value than the whole of the electrical exports in 1938.

Disturbing Effects of Legislation

It would be false modesty not to agree that the electricity supply industry was the most progressive of the nationalised industries, and the electrical manufacturing industry the most progressive of private industries. "This notwithstanding," the President added, "I think I should be voicing the feelings of many people in this room if I said that at the moment both these sections of our industry are feeling a little battle-scarred. Both manufacturers and supply have recently experienced the

disturbance of a detailed inquiry; both have been the objects of recent legislation. One should not underestimate the disturbing effect on organisations and on staff of too frequent upheavals in the pattern of their work. Years of uncertainty and frustration go by whilst inquiries are being held, reports are being prepared and considered and action taken, and this may do more damage to the national well-being than can be rectified by any marginal gain which may be the outcome of the enforced change. With progressive management, which must be there in any case if we are to survive, it is open to doubt whether major legislation is better than evolutionary reorientation where large basic industries are concerned. If the results of the present legislation are tolerably successful, I am sure that I speak for both sides of the industry when I say that it is our earnest hope that we shall not be the subject of further legislation for a long time to come. Should further legislation be necessary, it will do the minimum damage to morale if the gestation period is not of such elephantine duration."

In spite of these problems and other economic difficulties, they viewed the future with confidence. They were on the brink of great developments in the field of nuclear power. Nuclear fission was simply another means of producing heat and provided a heat source which was complementary to coal but would not supersede it.

In conclusion, the President paid a tribute to Lord Citrine, whose leadership and desire to co-operate with all sections of the industry had enabled the previous transition to be effected smoothly. The spirit of co-operation thus engendered had been responsible for much of the great technical progress which had been made and within the supply industry had produced a growing sense of loyalty to the national organisation. Lord Citrine might take comfort from the fact that it had taken an Act of Parliament to demolish the C.E.A., but the work so well begun would be remembered as a great personal achievement of a very great man.

The Mayor of Eastbourne (Alderman Caffyn), replying to the toast of the guests, which was proposed by Sir Henry Self in a characteristic speech, said that from the time they were awakened in the morning by an electric alarm clock until they went to bed, in winter, under an electric blanket, they were continuously indebted to the electrical industry. It was not only a question of the growing number of electrical appliances which they used; the production of clothes, their food and almost everything they used was aided by electrical power. The variety of the applications of electricity was astounding, particularly as the growth of the industry had taken place within the lifetime of many who were still living. Eastbourne had been incorporated as a borough in 1883, and the first a.c. generator had been produced by Dr. Ferranti and others in that year.

Sir Josiah Eccles congratulates his successor—Sir George Nelson

Annual General Meeting

After the formal proceedings at the annual general meeting on 21st June, Sir Josiah Eccles introduced his successor, Sir George Nelson. Sir George, he said, was a leader of industry; he was chairman of eight manufacturing companies as well as a director of others, he was a past-president of the I.E.E., and the present president of the Institution of Mechanical Engineers. In acknowledging his appointment, the new president said that he greatly appreciated the honour accorded him and was very happy about the cordial co-operation which existed between the various branches of the electrical industry. He echoed every word which had been said in praise of Lord Citrine, the founder of the Convention, at the previous evening's dinner. He then presented Sir Josiah Eccles with the past-president's badge.

Sir Josiah congratulated Sir George Nelson and then announced that the new vice-president was Mr. C. R. King, chairman of the East Midlands Electricity Board. Mr. King acknowledged his election and the president

Sir Josiah invests Mr. C. R. King with the vice-president's badge

then reminded the members that the 1958 Convention was to be held at Brighton during the week commencing 16th June. He then thanked all those who had helped to make this year's Convention such a great success. Some might feel, he remarked, that there had been too many papers and that the time left for discussion had been inadequate, but it must be remembered that the papers went far afield. They went to all the Commonwealth countries, and there had been good repercussions in the reverse direction as a result of the information disseminated in that way.

The proceedings concluded with a vote of thanks to Sir Josiah Eccles moved by Sir Vincent de Ferranti to which Sir Josiah briefly responded.

Metro-Vick Gift to University

The Council of Sheffield University has accepted the sum of £4,000 from the Metropolitan-Vickers Electrical Co., Ltd., for the provision of electrical equipment for the Department of Mechanical Engineering.

NEW ELECTRICAL EQUIPMENT

New Dielectric

A new wire known as "Merad," which was first introduced at the recent Electrical Engineers' Exhibition, is now in limited production by MERSEY CABLE WORKS, LTD., Linacre Lane, Bootle, Liverpool, 20. It incorporates an irradiated modified polythene dielectric for use in higher than normal temperature conditions.

The implications of this development when applied to the manufacture of wiring and cables are considerable. Soldering, for example, may be carried out right down to the insulation and irradiated polythene cable may now be used for applications where high external temperatures are experienced. In addition, momentary overloads which formerly damaged or destroyed the insulation are made harmless. This new dielectric does not melt when exposed to higher temperatures, but is converted to a rubber-like substance which retains some useful strength up to a temperature of 450 deg C. Tensile strength, elongation, and abrasion resistance are improved, while handling and flexibility are virtually unchanged.

The new material provides a valuable supplement to existing methods of sleeving and "encapsulation." When irradiated, extruded sleeving with an inside diameter of $\frac{1}{4}$in can be cold distorted to an inside diameter of $\frac{1}{8}$in or more to fit over terminals or components. Upon momentary reheating to between 135 and 150 deg C it attempts to return to its original $\frac{1}{4}$in inside diameter and thus encapsulates the component or terminal.

Earth-Leakage Circuit-Breakers

A new double-pole voltage-operated earth-leakage circuit-breaker (the E60) which complies fully with B.S. 842 and other requirements, has been introduced by J. A. CRABTREE & CO., LTD., Walsall, Staffs. The range embodies four units which combine accurate overload and short-circuit tripping with earth-leakage protection. When supplied without overload protection the unit has a standard rating of 60 A 500 V a.c. Units with overload and short-circuit features have alternative current ratings of 15, 30, 45 and 60 A.

The units, which can perform all the functions normally carried out by the conventional main fuse, main switch and earth-leakage trip combination, constitute an efficient method of sub-circuit control and occupy much less space and effect some saving in installation costs.

Tripping under overload and short-circuit conditions is achieved by a simple, hermetically-sealed, time-delay device embodying the magnetic-hydraulic principle. It will tolerate harmless temporary overloads such as initial switching surges but will trip instantly on heavy overloads or short-circuit faults. The operating time under short-circuit or earth fault conditions is about 10 to 15 millisec.

Energy Regulators

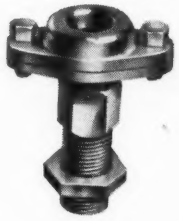
An energy regulator rated at $2\frac{1}{2}$ kW 250 V a.c. introduced by "DIAMOND H" SWITCHES, LTD., Gunnersbury Avenue, London, W.4, has been designed to meet the continued demand for a reliable simmering device for cooker hotplate control. The regulator can be used in conjunction with all types of conventional radiant or solid, single, two or three circuit plates, provided total loads do not exceed $2\frac{1}{2}$ kW at 250 V a.c. It can also be applied to percolators, infra-red grills, warming plates and other suitable appliances.

Energy regulation is accomplished by interrupting the current flow to the appliance for short intervals by the opening and closing of a snap action bi-metal switch. Two sizes are available for rear of panel mounting; both are provided with single "D" spindles, location lugs and fixing bush for $\frac{5}{16}$in max. panels and are interchangeable in these respects with all current standard a.c. heater switches.

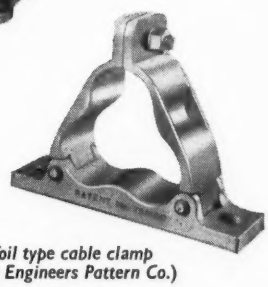
New features are a fully reciprocating mechanism which enables the handle dial to be turned direct to the "full" position from "off," thus by-passing the simmering position, indexed "off" and "full" positions, rear wiring, shallow projection and rigid wiring terminals.

Flameproof Cable Glands

WALSALL CONDUITS, LTD., Excelsior Works, West Bromwich, have recently introduced a stuffing gland similar to that used on mining gear for rubber or plastic insulated cables used in industrial installations. Three types are available: (a) No. 1763BX, for internally armoured flexible cable; (b) No. 1762BX, for v.i.r. or plastic insulated and armoured cables; and



Gland for v.i.r. or plastic insulated lead sheathed and armoured cables (Walsall Conduits)



Trefoil type cable clamp (London Engineers Pattern Co.)

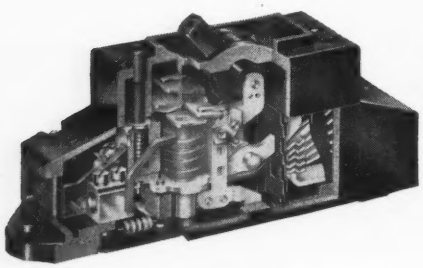
(c) No. 17668X, for v.i.r. or plastic insulated, lead sheathed and armoured cables. The range covers sizes from $\frac{3}{8}$in to $1\frac{1}{2}$in diameter under the armouring.

The glands have been certified as flameproof, for use in Groups 2 and 3 installations, and the design has been approved for use with all makes of certified flameproof equipment in works subject to the Factories Act, 1937.

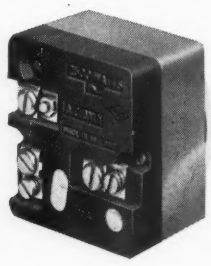
Where local conditions are bad it may be still necessary to compound seal rubber cables to prevent deterioration of the insulation, but in normal conditions these glands will provide a more economical and neater method of terminating cables in flameproof apparatus.

Cable Clamps

A rigid leg specially designed to avoid fracture is a feature of a range of cable clamps made by the LONDON ENGINEERS PATTERN CO., LTD., Waddon Marsh Works, Purley Way, Croydon, Surrey. Both single and trefoil types are available in aluminium or bronze for all sizes of cables with alternative methods of fixing.



Crabtree type E60 earth-leakage circuit-breaker



Energy regulator ("Diamond H" Switches)

INDUSTRIAL NEWS

Ferranti Awarded T.V.A. Contract

In the face of strong competition from several American, Continental and other firms, Ferranti, Ltd., has received an order for transformers worth nearly a million dollars from the Tennessee Valley Authority, U.S.A.

Announcing this in London on Monday, the company stated that the order covered eight 33,333 kVA, 154 kV single-phase transformers at a total cost of $994,920. Six would be used to form two three-phase banks and the remaining two would be used as spare units.

In the past six years Ferranti, Ltd., has secured from America orders worth over $5½ million (£1,971,326) for 56 transformers with a total capacity of nearly 2½ million kVA. In addition 13 transformers worth nearly $1¼ million (£448,028) have been ordered from Canada.

Generating Plant for the Lebanon

The British Thomson-Houston Co., Ltd., has obtained an order for a 30 MW turbo-generator for the extension of the Chamoun power station at Zouk Mikael, Beirut, in the Lebanon. The steam turbine will consist of a single-cylinder 3,000 r.p.m. 17-stage machine, to operate under steam conditions of 600/625 lb/sq in at a total temperature of 850/875 deg F, the turbine being direct-coupled to a 35,294 kVA (max.), 11 kV, 50 c/s, three-phase, 0·85 power factor air-cooled alternator. The condensing, feed heating, and evaporating plant is also being supplied by the B.T.H. Co. as also are the boilers, which will be made by International Combustion, Ltd. The contract was obtained in the face of severe competition. One of the determining factors was early delivery, the B.T.H. Co. undertaking to commission the set by mid-1958.

E.T.U.'s Financial Position

In *Electron*, the Electrical Trades Union's monthly journal, Mr. Frank Haxell, the general secretary, says that the funds of the union need strengthening "in order to meet the struggles which lie ahead and to continue to pursue policies which have been determined by the membership." The first and most essential step was to increase the liquid assets of the union to a total of £500,000 so as to be able to meet any possible situation which might confront it in the immediate future; secondly there must be an all-out drive by all members to reach the quarter of a million membership mark; and thirdly there must be a decisive effort to reduce the members' arrears.

The article emphasises that the union is not insolvent and says the executive is determined that the union would continue to play the role in the trade union and Labour movement that it had played in recent years. To do this it was essential that the annual income of the union should be increased by £100,000.

Progress at Berkeley

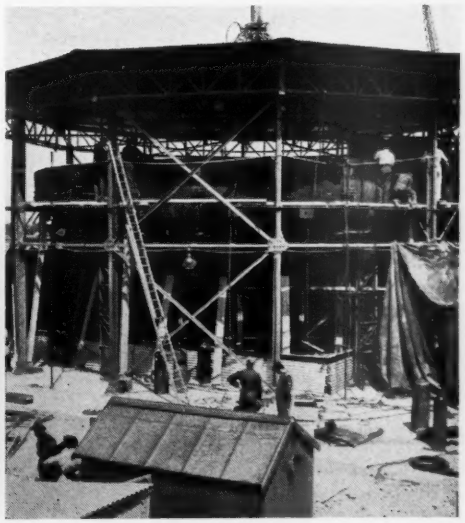
At the site of the Berkeley (Glos.) nuclear power station the lower part of the No. 1 reactor vessel is now being erected on its temporary foundation. To avoid delay, the vessel is being built alongside the site of the reactor house, under a removable cover which is lifted as construction proceeds. Completion of the permanent foundations in the reactor building will coincide with the completion of this portion of the vessel, which will then be moved on its bogie to the centre of the pit at the level at which it now stands and will then be jacked-down some 6ft to its final position. The station is being constructed for the Central Electricity Authority by the A.E.I.-John Thompson Nuclear Energy Co., Ltd.

Electricity Supply Joint Consultation

The text of the National Agreement for Joint Consultation in the Electricity Supply Industry made by the Electricity Boards and trade unions in March last has now been published by the National Joint Advisory Council for the industry. In a foreword, Lord Citrine, chairman of the Central Electricity Authority and of the N.J.A.C., says that the new agreement incorporates substantial changes in the constitutions of the advisory councils and committees. These changes have come about partly because of legislation affecting electricity supply in Scotland and partly because of the recent review of the working of the advisory machinery itself.

A National Joint Advisory Council for Scotland has been established. This Council and the N.J.A.C. for England and Wales will each nominate a liaison member to serve on the other Council and the recommendations of each Council will be exchanged and considered by the other. Lord Citrine adds that the clauses which provide for local advisory committee elected representatives to sit on the District

Left: View across the 30ft deep excavation for the reactor house foundations at Berkeley. Right: Lower part of the reactor vessel being welded together under cover



and National Joint Advisory Councils open a new and promising chapter in the history not only of the industry but of the country.

Brussels Exhibition

Troughton & Young, Ltd., have been appointed official electrical contractors to the British Government Pavilion at the Brussels Exhibition, 1958 (Exposition Universelle et Internationale de Bruxelles, 1958). Howard V. Lobb & Partners are the co-ordinating architects.

Morphy-Richards "Coming-of-Age"

Morphy-Richards, Ltd., which was formed in 1936, celebrates its coming-of-age this year and to mark the occasion the company has produced an attractive booklet, written and illustrated by Bernard Hollowood, which outlines the rapid progress made by the company over the past twenty-one years. The text, which is written in breezy style, records that the company produced 20,000 domestic appliances in its first year, employed fewer than twenty people, had an issued capital of £1,000 and its works had a floor space of 4,000 sq ft. Sales totalled £10,000 and profits were £735. This year the annual rate of production of domestic appliances of all types is 3,250,000, the factory space is now 400,000 sq ft, employees total 2,400, the issued capital is £648,725 and sales have risen to more than £5·5 million. The wide range of appliances now produced includes electric irons, automatic electric toasters, hair dryers, spin dryers, door chimes, fires, convection heaters, electric blankets, suction cleaners and refrigerators.

New Control Gear Factory

An informal cocktail party was given recently by M.T.E. Control Gear, Ltd., to mark the opening of their new factory at Leigh-on-Sea, Essex. Guests included customers, suppliers and friends in the electrical industry, many of whom have been associated with the firm since its earliest days. During a tour of the works they were shown a representative display of the company's new "Progress" range of control gear components and also inspected a large batch of specially designed multi-motor control panels ready for dispatch to various machine tool and other manufacturers.

Safety and Factory Efficiency

The Birmingham and District Industrial Safety Group held its fourth biennial Safety and Factory Efficiency Exhibition and Congress at Bingley Hall, Birmingham, from 14th to 21st June, the sixty stands occupying a greater total area than at any previous exhibition. A feature of this year's exhibition was a display, "Atom 1957," by the United Kingdom Atomic Energy Authority. A cinema showing films on various aspects of safety was in continuous operation during the exhibition.

In conjunction with the exhibition a special week-end conference was arranged. The speakers and subjects included "Training for Atomics," by Mr. Ivor Hopkins, B.Sc. (chief training officer, Industrial Group, United Kingdom Atomic Energy Authority); "Isotopes in Industry," by Mr. H. Seligman, Ph.D. (head of Isotope Division, Atomic Energy Research Establishment, Harwell); "Health and Safety when Using Radioactive Materials," by Mr. A. S. McLean, M.B., Ch.B., D.I.H. (chief medical officer, Industrial Group, A.E.A.); and "Atomic Reactors," by T. M. Fry, B.A.(Cantab.), a physicist in the Reactor Division, A.E.R.E., Harwell.

Danish Research Reactor

Head Wrightson Processes, Ltd., announce that they have been awarded a contract by the Danish Atomic Energy Commission for the design, engineering and erection supervision of a materials testing reactor similar to those they are now building for the United Kingdom Atomic Energy Authority at Harwell and Dounreay. It is planned that the reactor will be completed before the end of 1959. This "Pluto" reactor is of the enriched uranium heavy water moderated type with a flux of 10^{14} neutrons per cm^2/sec at a thermal output of 10 MW.

The Danish "Pluto" reactor, which will be erected at the Atomic Research Centre at Riso, will enable essential research to be conducted on the testing of materials under the effects of irradiation.

Head Wrightson Processes are at the moment engaged on four research reactors (three for the U.K.A.E.A. and one for the Australian Atomic Energy Commission); this order is their second for export. The contract has the approval of the U.K.A.E.A., who will supply the necessary enriched fuel elements.

Large Catering Installation in West Africa

James Stott & Co. (Engineers), Ltd., Oldham, have recently supplied the catering equipment for the new Adjabeng Departmental Store in Accra, West Africa. The accompanying picture shows a portion of the 47ft long cafeteria service counter which incorporates a cold lunch section, hot meal counter, cold salad servery, soft drink, ice cream and coffee section, the latter incorporating a "Connoisseur" pressure type café set, which can be seen on the photograph. In addition, Stotts supplied the kitchen equipment, including deep fryers, boiling pans, infra red grillers, dishwashers and food machinery.

The cafeteria in a West African Departmental Store

Submarine Telephone Link

An understanding has been reached between the British Post Office, the Danish and Iceland Administrations and the Great Northern Telegraph Co. for the laying of a coaxial submarine cable between Iceland and Scotland via the Faroe Islands. The new cable will be a combined telephone and telegraph cable. It will improve telecommunications with Iceland and the Faroes and make it possible to establish telex services with these places. Furthermore, the cable will contain a number of telephone and telegraph connections for the use of the civil aviation services, and especially for the control of the trans-atlantic air routes. The Post Office will be joint owners with the Great Northern Telegraph Company of the cable between the Faroes and Scotland. It is expected that the cable will be brought into service in 1959.

Roll of Approved Contractors

The National Inspection Council for Electrical Installation Contracting has issued the first edition of its "Roll of Approved Electrical Installation Contractors," copies of which are available on application to the Council at 13, Victoria Street, London, S.W.1. The booklet is divided into three parts: a geographical section, an alphabetical list of contractors and an alphabetical list of towns.

Colour Light Signalling

In connection with the electrification of the line to the Kent coast due for completion in 1959 British Railways have authorised contracts to be let for the extension of colour light signalling from Brixton through to Chatham, Sittingbourne, Faversham, Margate and Ramsgate, including the Sheerness branch.

The work will be undertaken by three signalling contractors, each

responsible for a section of the route. The inner London area from Brixton to Swanley will be carried out by the Westinghouse Brake & Signal Co., Ltd., the central area from Swanley to Sittingbourne, including the Sheerness branch, by the Siemens and General Electric Co., Ltd., and the Sittingbourne to Ramsgate section by the Metropolitan-Vickers Electrical Co., Ltd. Nearly 400 new colour light signals and over 100 electrically operated shunt signals will be introduced.

Czechoslovak Mission for Ceylon

Our Colombo correspondent reports that the Czechoslovak Government has been asked to send a team of experts to plan a second hydro-electric plant in Ceylon to provide power for a number of industries, including a fertiliser factory. They will be asked to investigate the possibilities of setting up an industrial town.

Earlier, the Ministry of Industries examined the possibilities of setting up a fertiliser factory in Ceylon, but preliminary surveys showed that lack of cheap electric power would make the project uneconomical. The Czechoslovaks in their offer to the Ministry of Industries have suggested that it will be possible to set up a fertiliser plant and provide the hydro-electric power as well. Excess power generated from the hydro-electric plant could be used for establishing several other industries in the area.

Works Visit

A party of twenty-four Midland electrical contractors and works electrical engineers were taken by F. Westerman, Ltd., on a visit to the lamp factory at Merthyr Tydfil of Thorn Electrical Industries, Ltd., on 13th and 14th June.

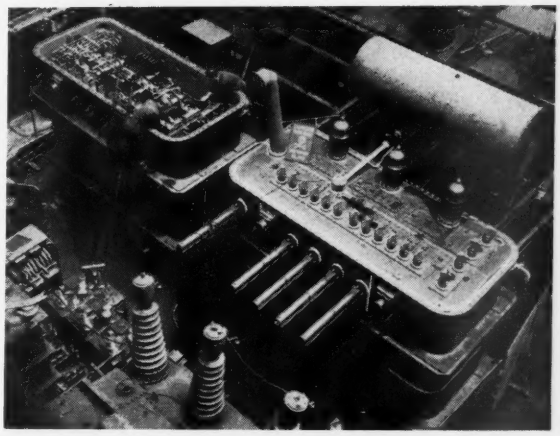
Leaving Birmingham by coach, the party spent the night at the Seabank Hotel, Porthcawl, S. Wales, where they were met by Mr. A. Shier, director, and Dr. H. H. Ballin, technical executive, of Thorn Electrical Industries, Ltd., by whom the party were entertained to dinner. Next morning, at the Merthyr lamp factory, the visitors were met by the works manager and senior members of his staff.

I.E.E. Radio Section Visit

The Radio and Telecommunications Section of the Institution of Electrical Engineers will be visiting Hatfield House on 13th July as guests of Standard Telephones & Cables, Ltd., whose works at Southgate they will visit in the morning.

Plant for Aluminium Smelter

Manufacture of plant comprising pumpless steel tank mercury arc rectifiers, transformers, switchgear, and associated equipment for the new aluminium smelter of the Canadian British Aluminium Co., Ltd., at Baie Comeau, near Quebec, is well in hand at the factories of the British Thomson-Houston Co., Ltd. The contract for this equipment, valued at nearly £2 million, was placed with B.T.H. early last year. Recently, the first of the sixteen rectifier transformers was dispatched from the Rugby Works; these transformers are rated for a rectifier output of 12,100 kW at 850 V d.c. When erected, complete with coolers, their weight will be approximately 72 tons. The winding arrangement is of interest. In addition to the three-phase 33 kV primary and six-phase 850 V secondary windings, a three-phase phase-shift transformer has been incorporated, and the degree of phase-shift will be varied for each transformer so that 48-phase overall operation will be obtained for each aluminium smelter line. The first eight transformers are due for commissioning at Baie Comeau in November next.



The first transformer for Baie Comeau on test at the B.T.H. Rugby Works. A second transformer can be seen under erection nearby

Radiation-Resistant Lubricants

When initial schemes for atomic power stations were being considered it was realised that among the problems to be tackled would be the lubrication of plant subject to radiation and to meet these requirements a range of radiation-resistant lubricating and hydraulic oils and greases has been produced under the brand name Shell A.P.L.

In addition to resistance to radiation, other properties are required in the lubricants for equipment of nuclear stations. For example, contamination of the reactor cannot be tolerated, so that any lubricants which might come in contact with the coolant gas of the reactors must have an extremely low vapour pressure. The lubricants must also in some cases be capable of withstanding high temperatures for long periods and there is the problem of compatibility of the lubricant with hot coolant, e.g. carbon dioxide under high pressure.

As a result of research work in which the Cobalt 60 source has played its part a number of special lubricants have been developed which are resistant to radiation and which meet the requirements of the nuclear power stations now being built for the C.E.A. Further research is continuing to develop lubricants for more advanced designs of nuclear power plant.

Telephone Exchange for Indian Refinery

A refinery, which will cost in the region of £8½ million, is being built by Caltex Oil Refining (India), Ltd., an associate of the American company, at Visakhapatnam, India. Spread over some 515 acres, the refinery will need speedy communication between all sections and, with this object in view, an order was recently placed with the Automatic Telephone & Electric Co., Ltd., through Indian Telephone Industries (Private), Ltd., for a private automatic branch exchange which will cater initially for 200 internal extensions. Known as the Type 211, the new automatic exchange has been specially designed to meet the needs of overseas users and the equipment is fully tropicalised. The refinery exchange will have an ultimate capacity of 300 telephones.

Japanese Atomic Energy Commission Visit

Mr. Koichi Uda visited Berkeley on 20th June to inspect the progress made by the A.E.I.-John Thompson Nuclear Energy Co. in building the 275 MW nuclear power station for the Central Electricity Authority. Mr. Uda was accompanied by three members of the Japanese House of Representatives and by others from the Atomic Energy Commission. Previously the delegation had visited the headquarters of the A.E.I.-John Thompson Nuclear Energy Co. at Radbroke Hall in Cheshire.

The "Cutty Sark"

On Tuesday last, the Queen, accompanied by the Duke of Edinburgh, opened the *Cutty Sark* at Greenwich, and it is now open to the public. This famous vessel has virtually become "all-electric." The complete installation covering lighting, space heating, cooking, water heating and floodlighting has been carried out with m.i.n.f.s. cables. The 3-phase 4-wire supply is taken from the London Electricity Board via a cubicle pattern William White main switchboard with William White combined switch-distribution boards at various positions on the ship. Lighting fittings in all situations have been designed to conform with their

surroundings. A secondary lighting installation supplied by the Tudor Accumulator Co., using lighting fittings by Wm. McGeoch, Ltd., employing 12 W, 12 V lamps, is available in case of mains failure.

The space heating installation consists of 500ft of "Maxheat" oval tube heaters loaded at 60 W/ft, all thermostatically controlled by six Ekco-Thermovent air thermostats and Rheostatic contactors, the maintained temperature being 50 deg F. In the galley there is a "Heatrae" water heater and a "Baby Belling" cooker.

The floodlighting of the dock and the masts and yards is derived from Simplex fittings. Floodlighting of special features is by fittings supplied by the G.E.C. and Rowlands Electrical Accessories. A lightning conductor installation connected to each mast terminating in earth tubes in the bottom of the dock was supplied by Furse & Co. The connected loads are as follows:—Lighting 15 kW, space heating 33 kW, water heating and cooking, etc., 10 kW, and floodlighting 23 kW. Five thousand yards of m.i.n.f.s. cable supplied by B.I. Callender's Cables have been used. The work has been carried out by R. & H. Green & Silley Weir, Ltd., the contractors for the refit of the *Cutty Sark*, under the direction of the Society's hon. consulting engineer, Mr. J. Rawlinson, C.B.E.

Conference on Automatic Production

The Institution of Production Engineers is holding a conference at Harrogate from 30th June to 3rd July, the theme of which will be "Automatic Production—Change and Control." During the conference discussion groups will deal with the many aspects of automation, and a number of papers will be presented by authorities on the subject. In addition to the business sessions there will be a civic reception by the Mayor and Mayoress of Harrogate, followed by a cabaret and dancing.

Board of Trade Regional Organisation

The Board of Trade announces that the regional offices at Nottingham (North Midland Region), Cambridge (Eastern Region) and Reading (Southern Region), and also the district offices, or sub-offices, at Liverpool, Whitehaven, Sheffield, Swansea, Rhyl and Dundee, will be closed from 1st July, when the following arrangements for continuing the Board's services in the areas affected will come into operation:—Work of the Nottingham office will be transferred to the Board's Birmingham office (Midland Region) except that relating to Lincolnshire, which will be transferred to the Leeds office (East and West Ridings Region), to be known in future as the North Eastern Region. Work of the Cambridge office together with that of the Reading office (except work relating to Hampshire, including the Isle of Wight, and Dorset) will be transferred to a new regional office (Eastern Region) which is to be opened in London on that date. Work of the Reading office relating to Hampshire (including the Isle of Wight) and the Borough of Poole (Dorset) will be transferred to the existing London regional office (London and South Eastern Region), and that relating to Dorset (except Poole) to the Bristol office (South Western Region). The Board's district office at Inverness will continue as at present but the work of the six district offices to be closed will be transferred to the respective regional offices.

"Atoms for Peace"

On Thursday last week there was a private showing in London of a Russian documentary film, "Atoms for Peace." The film (35 mm) has been made by Plato Films, Ltd., 18, Greek Street, London, W.1, and there are coloured and black and white versions; it runs for 75 minutes.

Although the film is continuous it is in three distinct parts; the first explains how an atomic reactor works and the types of reactors in use in the Soviet Union, the second shows the uses of radioactive material for medical purposes, and the third, industrial and agricultural uses. The English commentary is good and can be easily followed by a non-technical audience.

Plastics Institute

The annual general meeting of the Plastics Institute will be held in the Conference Room, Gallery, National Hall, Olympia, London, W.14, at 12 noon on 19th July, and will be followed by the annual luncheon, which will be held this year in the Addison Café at Olympia.

"Drive-in" Cinema-Theatre

The "drive-in" cinema-theatre which has become popular in America, Australia and South Africa, has, from the owner's point of view, the attraction of low cost of construction as compared with the orthodox cinema. One of the latest to be constructed is at Port Elizabeth, South Africa, for which the British Thomson-Houston Co., Ltd., has supplied the projection equipment. This "drive-in" cinema-theatre and the equipment installed is described by Mr. J. Moir, of the B.T.H. Electronics Engineering Department, in an article he has contributed to "B.T.H. Activities."

Black & Decker Sales Campaign

The latest Black & Decker sales campaign is designed to extend the potential market for portable electric saws and sanders. In addition to various forms of publicity material, special window display units are available to dealers throughout the country.

To further stimulate interest in the saws and sanders, three Black & Decker Bedford vans have been fitted with circus-tent tops to tour the campaign areas. Carrying small petrol-driven generators for supplying electricity, these vans will give public demonstrations of the tools.

Fire at Lydbrook Works

A fire occurred recently at the rubber mill at the Lydbrook cable factory of the Edison Swan Electric Co., Ltd. By Monday, 17th June (i.e. within a week of the fire occurring) the factory was again in full production.

Main Monogram Competition

R. & A. Main, Ltd., announce that the result of its recent competition for the design of a new monogram for use in connection with electrical appliances is as follows:—First prize (£50): Mr. D. Wright, Enfield. Second prize (£25): Mr. L. Hill, Golders Green, N.W.11. Third prize (£10): Mr. M. Collier, Falkirk. Three consolation prizes of £5 each have also been awarded.

Gauge and Tool Exhibition

The fifth Gauge and Tool Exhibition, organised by the Gauge and Tool Makers' Association, will be held at Olympia, London, from 12th to 21st May next year.

S.I.M.A. Luncheon

The annual luncheon of the Scientific Instrument Manufacturers' Association will be held on Friday next (12.30 for 1 p.m.) at the Savoy Hotel, London. Mr. R. A. Butler, Home Secretary and Lord Privy Seal, and Sir John Maud, Permanent Secretary of the Ministry of Power, will be the chief guests.

Private Telephone Exchange

The new Longbenton (Newcastle-upon-Tyne) research headquarters of Thomas Hedley & Co., Ltd., which was officially opened by the Duke of Northumberland on 14th June, has been equipped with the latest type of Strowger private automatic branch exchange, supplied by the Automatic Telephone & Electric Co., Ltd.

Trade Announcements

Mr. W. D. Seymour, 10, Halton Road, Sutton Coldfield (telephone: 6602), has taken over the agencies for Erma, Ltd., and the M.C.B. Co. (Manchester), Ltd., in the areas of the Midlands and East Midlands Electricity Boards. He has also taken over the agency for Ottermill Switchgear, Ltd., in Warwickshire, Worcestershire and Staffordshire.

Until recently the interests of **Bastian & Allen, Ltd.**, have been looked after in Yorkshire and Lincolnshire by H.V.E. (Electric), Ltd. The company has now established its own branch office at Cabinet Chambers, 20a, Basinghall Street, Leeds, 1 (telephone: Leeds 31881), in the charge of Mr. R. W. A. Paul.

MINING ENGINEERING

PROCEEDINGS AT THE A.M.E.M.E. CONFERENCE

WHEN on Tuesday last week we called at the Waldorf Hotel, London, to register for the annual conference of the Association of Mining Electrical and Mechanical Engineers, Mr. G. G. Middleton, convenor of the conference, told us he was expecting to register 600 members and visitors. The conference opened formally on the Wednesday morning when the annual general meeting was held. This was followed immediately by the delivery of the presidential address by Mr. J. E. Ridley, area chief engineer, North East Durham Area, Durham Division, National Coal Board.

Mr. Ridley chose "Men, Materials and Machines" as his subject and under the first head referred to the lack of trained and qualified mechanics and electricians. All too often, he said, trained electricians or mechanics did labourers' duties because such labour had not been made available by the appropriate authority. That was a waste of talent as deplorable as any other form of waste. Mr. Ridley also suggested that the problem of the shortage of qualified personnel could be countered by planned maintenance schemes.

Dealing with materials and machines, he said that one easily attainable objective was that existing machines should be so designed and manufactured that they worked—and kept on working. Many mechanical failures were due to ignorance of design principles, chiefly fatigue failures, accelerated by notches and stress raisers, and inadequate sealing and lubrication of bearings, the last two being accelerated by distortions. Most materials were specified by performance under single-stroke test, but machine failures were hardly ever due to a single stressing.

In collieries of the future, when degradation of coal would not be a disadvantage, the President said he envisaged fast-moving coal-getting and coal-loading machines, with automatically advanced roof supports, associated with conveyor and locomotive transport from the face to pit bottom, and multi-rope friction winders transporting the coal to bank. The labour force would be reduced underground to a team of skilled supervisors, including mechanics and electricians, and to accomplish this every advantage would need to be taken of our growing knowledge of automation. Electronics would play a large part in the scheme, which could result in automatic control of the coal-getting and coal-loading machines, together with remote indications or records of temperatures, pressures and electrical motor loads. The chief assets of electronic equipment were that it would give reliable service and could be built up into compact assemblies, saving weight and space.

Above : Mr. J. E. Ridley delivering his presidential address, "Men, Materials and Machines" on Wednesday morning

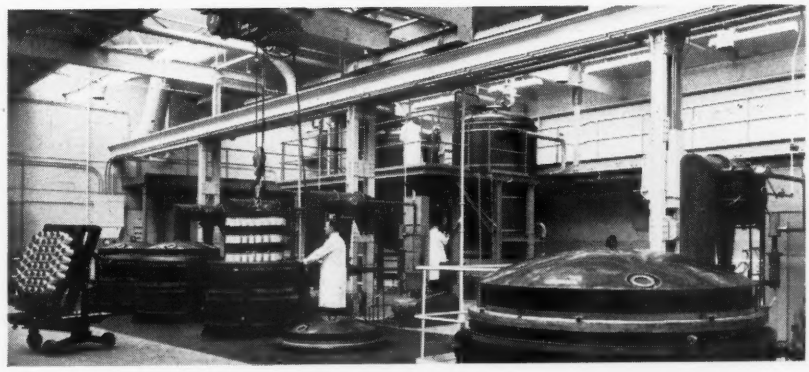
The prosperity of the National Coal Board and the economy of the country would depend on a sufficiency of properly qualified men, correct materials, and machines specially designed to meet the power-loading and transport problems.

At a technical session on Wednesday afternoon Dr. L. C. Tyte, C.B.E., B.Sc., Director, Mining Research Establishment, National Coal Board, presented a paper on "Instruments for Pit Measurements: Some Aspects of the Mining Research Establishment."

Dr. Tyte stated the desiderata of measuring techniques and instruments as: ability to record with appropriate accuracy the effect to be observed, introducing the minimum of change in that effect; their measurements must be repeatable; stability, requiring a minimum of recalibration; absolute dependability, when they controlled health and safety, in which case no instrument at all would be preferable to an unreliable one; intrinsic safety or used in a flameproof box; easy portability (unless in a fixed position) and hence of restricted dimensions and, above all, as light as possible; compactness and efficiency in power supply for a given weight.

The induction of the new president took place after the annual general meeting on Wednesday morning

Whereas almost all measurements made underground were mechanical rather than electrical (mainly those of forces of some kind), mechanical methods were not particularly adaptable to pit measurements. Mechanical instruments broadly speaking required moving parts which tended to seize or become unreliable in pits with heavy concentrations of dust and the likelihood of corrosion of moving parts. Secondly, to arrange remote recording of a mechanical instrument was difficult, lever systems or hydraulic or compressed-air transmission pipes not being so convenient as electrical



At the Johnson & Phillips works on Thursday a party was particularly interested in the new capacitor factory

leads. Thirdly, a reasonably high frequency response imposed severe requirements on mechanical systems, particularly if the normal criterion that the response frequency of the measuring instrument should be at least ten times greater than the frequency being observed was applied.

For those reasons the general trend was towards electrical systems consisting, in principle, of a transducer (converting the quantity to be measured into a suitable electrical signal), the transmitting system (taking the signal from the measuring point to an observation post) and, finally, the recorder giving a permanent record of the observation. As an electrical system introduced potential electrical hazards, that had delayed its general adoption to the harm of the industry in view of the unsatisfactory nature of mechanical methods.

Recent advances, however, had helped to alter the picture, such as the introduction of recording instruments of much greater sensitivity and hence requiring less electrical power to operate them. The recent development of transistors operating on a much lower voltage offered considerable hope of introducing amplification safely into underground electrical systems. Another potential increase in safety might come from the "potting technique" introduced initially for service applications in which electronic circuits were required to withstand large accelerations. The advantage in mining seemed to be that equipment surrounded by a solid mass in a box gave far less space for methane, hence the fire and explosion risk called for a less massive container than that needed to meet flameproof requirements.

Discussion

Mr. J. D. Morton (past-president), in opening the discussion, asked how strain gauges were secured to the tube casings, and whether special treatment was introduced to enable the instrumentation head to withstand the atmospheric conditions which are normally encountered in mines.

In reply, Dr. Tyte said that strain gauge cement was used. Atmospheric conditions had been countered by using a wax or cement to fill the gauge. There was, however, a tendency for that to shrink and to pull the gauges away from the cylinder, although normally they were firmly sited.

Mr. E. Loynes (N.C.B.) referred to multiple-circuit transmissions of a large number of readings at a remote distance, and asked whether there was any difficulty in regard to the intrinsic safety associated with it.

The reply was that there was no inherent difficulty with the use of transistors. In reply to a question by Mr. Norman Dudley (Powell Duffryn Technical Service), Dr. Tyte said he could see no particular difficulty, using modern electronic techniques, in measuring variations in hydraulic transients however rapid.

Mr. S. J. Ayres (Ministry of Power) made a plea for the proper instrumentation of plants so that those concerned knew what was going on and could thereby control the plant in an efficient manner.

Mr. T. E. Green (N.C.B.) referred to coal-face machinery and said he could appreciate that the measurement of the forces involved was probably well under control, but in the interpretation of those forces unknown quantities had to be dealt with.

In reply to Mr. D. M. Wardlaw (N.C.B., Scotland), who asked whether some more effective method than the oscillograph could be produced for dealing with winding ropes, Dr. Tyte said that the Mining Research Establishment had not been directed to go into it, since research could only be carried out on those problems which were of most significance to the Board.

Mr. C. D. Wilkinson (N.C.B.) referred to the relative stress in the four ropes of multi-rope winders, which would, to a large extent, be self-regulating. In other words, they would have a series characteristic in which they would relieve themselves of load. Experience with the first of the multi-rope winders had shown that adjustments were not required too frequently.

Mr. H. Watson-Jones (N.C.B.) asked the author whether the problems which he now encountered in the coal mining industry due to the many variables were greater than those encountered in his work with the Atomic Energy Research Authority and on guided missiles.

Dr. Tyte replied that the problems were of a different kind because in the pit there were much more difficult working conditions.

Mr. P. H. Harvey, Mr. E. Ivor David and Mr. S. Flax also took part in the discussion.

On the Wednesday evening the thrills of the Royal Military Tournament at Earls Court were experienced by a large number of the delegates.

Thursday was an out-and-about day for everybody. The gentlemen were split up into several parties, six of which visited works of notable electrical manufacturers in the London area, while another party took part either as players or sightseers in the annual golf tournament for the Heyes Trophy at the Royal Mid-Surrey Golf Club at Richmond.

The ladies also embarked upon various visits which included in one case a visit to the Houses of Parliament followed by a tour of the London docks. Others went on a river trip to Hampton Court Palace or a tour of the Dickens countryside in Kent.

Works Visits

At the Erith works of British Insulated Callender's Cables, Ltd., the visitors saw a major reorganisation scheme which involves the concentration of all the manufacturing operations in one building of about 340,000 sq ft. This also includes a new high voltage testing and development laboratory.

At the Hayes establishment of the British Electric Transformer Co., a tour of the works gave visitors the

opportunity of inspecting the company's productive processes and plant layout which is involved in the manufacture of power transformers included in a range from five to 120,000 kVA and for voltages up to 275 kV.

Members who visited the Fraser & Chalmers Engineering Works at Erith saw in part what may be described as the mechanical engineering centre of the General Electric Co., Ltd. The products here ranged from steam turbines, compressors and blowers of the largest sizes down to mining machinery of all kinds, including winding engines and crushing machines.

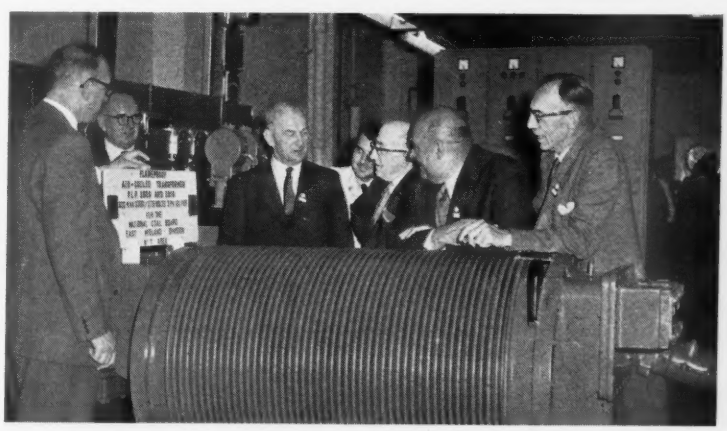
Those who went to Hackbridge had a dual works visit which included the works of the Hackbridge Cable Co., Ltd., and the Bryce Electric Construction Co., Ltd. In the cable works the visitors followed a cable through its numerous stages of manufacture from the drawing of the copper wires to the test bay where the cable was subjected to rigid electrical tests. In the Bryce works the visitors inspected a modern well-equipped transformer factory with work up to and including 20,000 kVA equipment.

At the Brentford works of Siemens-Schuckert (Great Britain), Ltd., interest appeared to centre on flameproof equipment such as control panels for coal cutters, loaders and conveyors, as well as a 200 A circuit-breaker built to National Coal Board specification.

At the Charlton works of Johnson & Phillips, Ltd., the highlight was the production of paper insulated rubber and thermoplastic cables and of transformers, many of the equipments being of special interest to mining electrical engineers. Visitors also saw the new capacitor factory.

At the Willesden works of the British Thomson-Houston Co., Ltd., visitors saw in various stages of production ranges of switchgear from low voltage air and oil circuit-breakers up to the 275 kV Type JW oil circuit-breaker, many units of which are in service in stations on the Central Electricity Authority's supergrid. Members of the B.T.H. staff demonstrated switchgear units, including the 3·3 kV Class BP flameproof horizontal drawout pattern and 11 kV air-insulated Class QA switchgear, which is employed for surface distribution in many British collieries. The visitors were also able to see the assembly of the automatic circuit recloser which has been developed for 11 kV rural distribution.

A visit was paid to the London Transport Executive Signal School, which has been housed in a temporary building at Earls Court since the last war, schemes prepared for a new building not having yet matured. The school, which is under the control of a chief inspector, is used for the examination of all new entrants to the service, for the training of staff, for the passing out of staff seeking promotion, for refresher courses and for signalling course lectures. Its equipment includes signalling apparatus of the types in service on the L.T.E. lines, including power operated points, train stops and signals controlled from a power frame. There are also working models of speed-control signalling and of remotely controlled signalling operated by push-buttons. The staff are given opportunities to dismantle and re-assemble the apparatus and to carry out practical tests on it.



The highlight of the visit to the Siemens-Schuckert works on Thursday was the production of flameproof and other mining equipment

Thornton Lecture

Friday morning's session opened with the ninth W. M. Thornton Lecture by Dr. T. E. Allibone on " The Impact of Nuclear Energy on the Twentieth Century." He said that the electrical industry in Britain was vitally interested in the successful development of nuclear energy since there appeared to be no possible alternative solution to the adequate supply of power from any other fuel even in the next decade. This country had doubled its electrical consumption about every ten to twelve years over the past thirty years and there were no signs yet of any diminution of the rate of increase. Moreover, even now Britain used less than half the electricity used by Americans per head of population, and that was certainly one cause of the higher productivity in the United States compared with this country, for human labour cost from 500 to 1,000 times the cost of electricity in western countries.

Last year in this country 41 million tons of coal were consumed (including the coal equivalent of oil) in generating our electrical requirements; electricity from hydro-stations in Britain amounted to only a few per cent. In ten years' time the country might expect to need 68 to 70 million tons, and roughly 100 million tons in twenty years' time, after making allowance for the anticipated improvement in the thermal efficiency of turbines. Whatever increases were possible in coal production in the distant future, there seemed to be no possibility of supplying all the increase required in the next decade or two, except by importing fuel, and it was against that grim prospect that the rapid advance of nuclear power engineering was viewed with such satisfaction.

There was a strong probability that in ten years' time between one-quarter and one-third of all the country's needs would be generated in nuclear stations. It seemed very likely that in twenty years nuclear energy would supply well over half the country's needs and thereafter, if all went well, coal-fired stations would cease to be built.

Dealing with costs, Dr. Allibone said that the cost of the uranium stations now under construction would be about two and a half times the cost of the equivalent coal station, and that would be reflected in the running costs, although there seemed to be no reason to apply a different rate of depreciation. To the cost of the uranium station, however, must be added the interest charge on the initial cost of loading the reactor with uranium so that the total interest and depreciation charges were nearly three

times higher for uranium than for coal-fired stations.

The fuel cost depended on the location of a coal-fired station on the one hand; and the uranium fuel cost depended on the length of time the uranium rods might be left in the reactor before they must be withdrawn for reprocessing. The present estimate for reloading of the fuel elements resulted in an annual fuel cost of one-half that of the coal bill. Operating costs might be regarded as comparable, so the gross annual costs were somewhat in favour of coal.

Against the cost of the uranium station there was a credit item not yet allowed for, namely, the value of the plutonium which could be extracted from the uranium bars. Estimates for the value of that differed rather widely—some were so high that they rendered the net cost of uranium power less in 1960 than coal—but more conservative estimates reduced the difference between uranium and coal to so small a figure as to be unimportant in making calculations of any significance to-day. The large programme of nuclear generation in 1960 would thus appear to be started on about an even cost with coal.

With the passage of years the real capital cost of uranium stations was likely to fall faster than the cost of coal stations, and the initial cost of fuel loaded into the reactor would certainly fall as reactors having a higher specific heat loading were designed.

A vote of thanks to Dr. Allibone was proposed by Mr. J. D. Morton and seconded by Mr. H. Watson-Jones, after which the president presented Dr. Allibone with the W. M. Thornton Bronze Medal.

Colour Television

A demonstration of closed-circuit colour television, using both a projection screen and direct-tube receivers, which was given at Friday afternoon's session by Mr. V. J. Cooper, B.Sc.(Eng.), A.C.G.I., chief television engineer, Marconi's Wireless Telegraph Co., Ltd., included some colour equipment on public view in this country for the first time.

Mr. Cooper had just returned from America, and he prophesied that within ten years there would be 10 million to 15 million colour receivers in operation there. "On the whole, the colour programmes are very well sent out," he said. "They are not always equally well received, because the Americans went all out two years ago to produce a receiver which would be low in price and would sell in great quantities."

Subsequently, he told the *Electrical Review* that a public colour service in this country was unlikely for at least five or possibly ten years. The standards had yet to be set, and here the T.A.C. had been advising delay; and even after they had been set, it would take three years to carry out the necessary tooling.

Mr. Cooper's paper was entitled "Vision-Television-Colour Television," and he opened by describing the properties of vision which were used for television. It was a property of human vision that the sensation produced by practically any colour encountered in real life could be simulated by an additive mixture of red, green and blue lights. This addition could be done simultaneously or, making use of persistence of vision, in time sequence. The sequential system was used in early colour television; a coloured disc was revolved in front of the camera lens to transmit to the camera in sequence the red, green and blue light content of the scene. At the receiver, the screen was viewed through a similar disc, revolving in synchronisation with the camera disc. Unfortunately, these transmissions could not also be used for black-and-white receivers; the picture repetition rate of each of the three colour signals had to be 50 pictures per second in order to reduce flicker, which required a total repetition rate of 150 pictures per second.

More definition was required in colours ranging from orange to cyan than for colours ranging from green to magenta, and the signal derived corresponding to the orange-cyan colours was transmitted with the greatest possible available bandwidth, while that on the green-magenta axis was transmitted with less bandwidth. These two separate pieces of chrominance information were transmitted separately on a colour sub-carrier, which would be received by normal black-and-white receivers as a pattern of dots, the size of the dots being governed by the frequency of the sub-carrier. The higher the frequency, the smaller and the less visible the dots.

Apart from the projection screen, the colour receivers were of the shadow mask colour tube type. The face plate—which was the viewing screen—had deposited on it a system of red, green and blue phosphor dots, arranged geometrically and with great precision in triplets. The shadow mask mounted behind the screen was pierced with a large number of holes, each hole registering with each triplet of the phosphor dots. Three electron beams, each independently modulated according to the separate red, blue and green signals, were deflected through the holes so that the appropriately coloured phosphor dots were excited to produce red, blue and green light in proportion to the beam modulation.

Annual Banquet

The annual banquet of the Association at the Dorchester Hotel concluded the proceedings of the Conference on Friday evening. In proposing the toast of "The Association," Mr. David Renton, T.D., Q.C., Parliamentary Secretary, Ministry of Fuel and Power, said that coal production was vital to Britain in spite of atomic energy and would remain so for the lifetime of every boy now entering the industry. The contribution which atomic energy could make, although significant, was nothing like as important as that which coal had to make for several generations to come.

If coal production was vital to Britain's future, the Association was certainly vital to the future of coal production, because if the country was to get the coal it needed, with the manpower which it had and was likely to have, the fullest possible use must be made of mechanisation and of every modern advance.

Mr. Renton expressed his amazement at the contribution which electricity was making to the mechanisation of the coal industry. The Mechanics' and Electricians' Regulations, introduced in 1954, would have the effect

At the annual banquet on Friday evening. Left to right: Mrs. Renton, Mr. D. Renton (Parliamentary Secretary, Ministry of Power), Mrs. Brown, Mr. E. H. Brown and Mr. B. L. Metcalf (chief engineer, N.C.B.)

that by the end of next year all collieries except those with comparatively little plant must have properly appointed mechanical and electrical engineers, with responsibility for the whole of the plant at the mine, who must hold qualifications which involved reaching the standard of a university degree in engineering or its equivalent. But he hoped that when the experts arrived at the colliery, they would regard it as their job to advise the manager and not to run the show for him. The manager must be the master of his own show and be given all possible authority and support.

In response the president emphasised that the Association, consisting of mechanical and electrical engineers, had the engineering problems of the coal industry at heart. For the first time since the Coal Mines Acts and Regulations came into being, the term "engineer" was now used to define a person who was responsible for the mechanical and electrical equipment employed in coal mining. It was gratifying to know that the honours, first-class and second-class certificates of the Association had been accepted as meeting the requirement for qualifications demanded under the Mechanics' and Electricians' Regulations. Often in the past, engineers at collieries felt that they were regarded as necessary evils. Now, however, it was recognised by all in authority that mechanical and electrical engineers were a vital necessity to the mining industry.

Mr. J. D. Morton, in proposing the toast "Our Guests," expressed thanks to Mr. Renton's colleagues at the Ministry for their efforts and co-operation in developing and extending safety in engineering in the mines.

In reply Mr. H. E. Collins, C.B.E., M.Eng., member of the National Coal Board, paid tribute to the Association's members for the great part they had played in the reconstruction and development of the coal industry. It was the Board's declared policy to go forward still more with the full mechanisation of coal-getting and its associated operations.

Power Supplies in Under-Developed Areas

REPORT Ref. C/T 118 of the Electrical Research Association, "The Combination of Local Energy Resources to Provide Power Supplies in Under-Developed Areas," by E. W. Golding, O.B.E., M.Sc.Tech., M.I.E.E. (price 21s), is concerned particularly with the problem of providing power, in the broadest sense, and amenities, to assist development in areas where remoteness from main power stations, and from fuel supplies, renders the use of conventional methods of power generation prohibitively expensive. The possibilities of utilising local energy resources such as wind, solar radiation and waste organic matter are discussed, and recent developments of equipment using these forms of energy are reviewed.

The conclusion is reached that such a combination might be a practical possibility though researches will be needed to ensure technical and economic success.

Letters to the Editor

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Measurement of Insulating Capacity

IN the early development of electrical machinery the application of insulation was more or less on "cut and dried" methods. To-day electrical insulation is one of the most important design factors in electrical industry.

With the development of new insulating materials, there has been a growing improvement in the space factor, high-temperature performances, and longer life of the electrical machinery with greater possibility of improving these factors still more.

But there is one question in mind. Has there been any research to devise some kind of indicating instrument or meter, or a device that will directly register the insulating reserve capacity of the insulating materials in service, just as ammeters and voltmeters, etc., indicate the conditions of the electrical behaviour? An authority of international repute has informed me that it knows of no successful device so far.

If such a device can be perfected, electrical machinery can be given a very long life. Perhaps an "electronic eye" may solve this problem.

London, S.W.19. ARTHUR R. NISSER, E.E.HONS. (U.S.A.), D.I.C.

The Ring Circuit

MY attention has just been drawn, on my return from a foreign tour, to Mr. Forbes Jackson's article in the *Electrical Review* of 24th May and to Mr. H. C. Cooper's letter in your issue of 7th June. As one who was very closely concerned indeed with the development of the fused plug, I should like to add to Mr. Cooper's letter.

After Mr. Jackson suggested to the Study Committee the use of ring circuits and fused plugs, he was faced with the difficulty of persuading a busy manufacturer to design, manufacture and market a fused plug in the extraordinarily difficult days towards the end of the war. Lesser men would have failed, but his friends know that if Mr. Forbes Jackson thinks it right that something should be done, he never rests until it is done.

Most certainly, not merely was the conception of the ring circuit with fused plugs the child of Mr. Jackson's brain, but he also provided the pertinacity which led to its adoption.

Manchester. THOMAS ATHERTON, *Chairman,* Dorman Smith Group.

Institution of Production Engineers

It is announced by the Institution of Production Engineers that a specialist group on materials handling has been formed within the Institution, under the chairmanship of Mr. A. G. Hayek, of A. G. Hayek & Partners, Ltd., Stoke-on-Trent. The purpose of the group is to provide a central forum for those members of the Institution having a special interest in materials handling. The activities of the group will include the organisation of conferences and lecture meetings.

Financial Section

STOCKS and SHARES

IN the industrial markets of the Stock Exchange there has developed lately a noticeable disposition for investment to favour shares associated with consumer goods. Implications of the wage increases negotiated earlier this year are accepted as one of the main reasons for the strong ascendancy since established by ordinary shares as a class over gilt-edged and other fixed-interest securities. It seems logical consequently that within the general movement there should be a special inclination towards those fields of enterprise where the wages are likely to be spent. This has become manifest in a renewed demand for shares of the popular shops and stores, and also of those companies supplying domestic appliances in their various forms. It is evidently on this account that the shares of firms specialising in electrical equipment of that description have lately shown up particularly well in the accompanying price lists.

Consumer Goods

This year's advance in the price of Hoover 5s shares has been an example of the rise in the popularity of consumer goods investments, and one of the outstanding performances in the electrical markets. Their present quotation of 44s goes against a price of only 26s at the beginning of the year. The annual report of the company, published in March, demonstrated that business (particularly in overseas markets) had recovered strongly in the second half of the year from the difficulties of the first part, and anticipated a further expansion of activities in the current year. Morphy-Richards 4s shares have also been in popular demand lately. Having begun this year at 12s, they are now 18s 9d. Accounts are made up to the end of this month, and the final dividend declaration can be expected, together with the preliminary statement of results, about October. A three-for-two scrip issue has been distributed since the last time. The 5s shares of Vactric, whose annual results are mentioned below, have risen this year from 13s to 21s 3d, and were only half that price at times last year.

Dividend Declarations

With their preliminary statements of results for the year ended last March, British Electric Traction and Vactric have lately declared increased dividends from higher earnings, and the absence of much change in the quotations for the shares suggests that in each instance the results had been anticipated with some accuracy. In the case of Vactric, larger provisions for tax and depreciation leave the net surplus little changed at £250,000, but this provides an ample surplus for reserves after the payment of ordinary dividends totalling 25 per cent (against 17½ per cent previously) for the year. B.E.T. are raising the year's dividend on the deferred stocks from 22½ to 25 per cent. The group profit (before tax) improved by the best part of half a million. On the new dividend rates, the yield on Vactric 5s shares at 21s 3d

Price Changes in

Company or Board	Nom. Value	Middle price 24th June	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	73½		3	3	4 1 9	80	73½
Brit. Elec. 1974/77	100	71⅓		3	3	4 4 0	78½	71⅓
Brit. Elec. 1976/79	100	75½		3⅓	3⅓	4 12 9	81½	75½
Brit. Elec. 1974/79	100	86½		4⅓	4⅓	4 18 3	92½	86⅞
Overseas Electric Supply								
Calcutta Elec.	£1	16/-	−1/-	6†	6†	7 10 0†	19/-	16/-
East African Power	£1	19/-	−6d	7	7	7 7 3	21/-	19/-
Nigerian Elec.	£1	17/6		10	10*	11 8 6	18/6	17/3
Perak Hydro-Elec.	£1	18/-		10	10*	11 2 3	17/6	13/3
Electrical Shares								
Aberdare Cables	5/-	12/6	+3d	17½	17½	7 0 0	12/6	9/9
Aerialite	1/-	5/9		45	48	8 6 9	6/-	4/9
Allen, W. H.	£1	46/9	−6d	10	10	4 5 6	47/3	33/6
Anglo-Portuguese Tel.	£1	24/3	+6d	8	8	6 12 0	27/6	20/6
Aron Elec. Ord.	£1	58/9x.d.		15	15	5 2 3	60/-	53/6
Assd. Automation	10/-	24/3	+1/-	5	7½	3 1 3	24/9	17/9
Assoc. Elec. Ord.	£1	63/9	−1/3	15	15	4 14 0	73/-	62/6
Automatic Tel. & El.	£1	75/-		15	17	4 10 9	75/-	54/6
Babcock & Wilcox	£1	71/3		15	15	4 4 3	82/6	71/6
Bakelite	10/-	24/6		16	15	6 2 6	24/6	20/9
Baldwin, H. J.	2/-	4/-		20	20	10 0 0	5/-	4/-
Berry's Electric	5/-	6/-		—	10‡	8 6 9	6/3	5/6
British Aluminium	£1	67/6		12	12	3 11 0	71/3	63/9
Brit. Elec. Traction: Def. Ord. "A"	5/-	23/6	−1/-	22½	25	5 6 6	24/6	17/-
B.I. Callender's	£1	52/9	+6d	12½	12½	4 14 9	55/-	48/3
B.I. Callender's 6% Pref.	£1	19/6	−6d	6	6	6 3 0	21/9	19/6
British Tabulating	£1	55/-		9	9	3 5 6	56/3	42/-
British Thermostat	5/-	25/-x.d.		25	25	5 0 0	27/6	25/-
British Vac. Cleaner	5/-	6/6		15	10	7 13 9	8/-	6/6
Brook Motors	10/-	36/3		25	15	6 18 0	36/3	30/-
Brush Group	5/-	7/9		10	Nil	—	8/-	4/6
Bulgin, A. F.	1/-	5/-		50	40*	8 0 0	5/6	4/6
Burco Dean	5/-	12/6		22½	20	8 0 0	13/-	8/9
Cable & Wireless: Ord.	5/-	12/-	+9d	10	10	4 3 3	12/-	9/6
4% Loan	100	90½		4	4	4 8 6	92½	89
Chloride El. Storage "A"	£1	67/6		17½	17½	5 3 9	68/9	58/-
Clarke Chapman	£1	175/-		22½	27½	3 2 9	8⅞	6½
Cole, E. K.	5/-	23/6		17½	17½	3 14 6	23/6	16/6
Cossor, A. C.	5/-	6/-		15	Nil	Nil	7/3	5/9
Crabtree	10/-	26/-		20	20	7 13 9	26/-	23/3
Crompton Parkinson Ord.	5/-	16/9x.d.		16	16	4 15 6	17/9	14/6
De La Rue	5/-	22/-		30	35	7 19 0	22/-	16/3
Decca "A"	4/-	27/-	−6d	43¾	43¾	6 9 9	32/3	27/-
Desoutter	5/-	33/6		30	32½	4 17 0	33/6	27/6
Dewhurst	2/-	7/-		30	16⅛*	4 12 9	7/6	5/9
Dictograph Tel.	2/-	6/-		20	20	—	6/3	—
Dubilier Condenser	1/-	6/6	+6d	25	30	4 12 3	6/6	5/6
Duport	5/-	19/-x.d.		23	25	6 11 6	19/6	17/6
E.M.I.	10/-	31/9	−6d	15	15	4 14 6	33/3	23/9
Electrical Components	5/-	7/6		25	25	8 6 9*	7/6	6/6
Elec. Construction	£1	27/6		8½	8½	6 3 9	27/6	21/9
Elliott Bros.	5/-	33/6	+2/6	17½	20	2 19 9	33/6	26/3
Enfield Cable Ord.	£1	15/-		Nil	Nil	Nil	21/6	13/-
English Electric	£1	60/-		12½	14	4 13 3	60/-	47/6
English Electric 3¾% Pref.	£1	12/6		3¾	3¾	6 0 0	14/3	13/-
Ericsson Tel.	5/-	49/-	+1/6	20†	22†	2 4 9†	49/-	33/3
Ever Ready	5/-	39/6	+2/6	35	37½	4 15 3	39/6	30/-
Falk Stadelmann	£1	39/6	−9d	17½	17½	8 17 3	40/6	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

goes up to 5·9 per cent, and on B.E.T. 5s "A" shares at 23s 6d to 5·3 per cent.

Allen West Scrip Issue

At the annual meeting of Allen West & Co., the chairman told shareholders that the necessary consents had been obtained for a scrip distribution in the proportion of three new 5s shares for every ten held. This will involve the capitalisation of part of the reserves which have been raised to over £1·6 million through the process of ploughing profits back into the business, and will have the effect of bringing the nominal capital (now £1,755,000) into better alignment with the amount actually employed. With another factory coming into full production last year, the results for the twelve months ended in January showed further expansion, the trading profit being nearly £200,000 higher at £1,287,000, and the net surplus of £471,000 (after tax) giving threefold cover for the ordinary dividend. This is being repeated at 15 per cent for the third year in succession, and provides a yield of 4¼ per cent on the 5s shares at 17s 9d.

Electrical Investments

Company or Board	Nom. Value	Middle price 24th June	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
Electrical Shares—continued						£ s d		
G.E.C. Ord.	£1	56/3		12½	14	4 19 6	58/9	48/9
G.E.C. 6½ Pref.	£1	21/6	−6d	6½	6½	6 1 0	23/6	22/-
General Cables	5/-	13/9x.d.		30	30	10 18 3	13/9	11/6
Greenwood & Batley	£1	47/6		17½	17½	7 7 3	47/6	45/3
Hackbridge Holdings	5/-	20/3	−6d	25	30	7 8 3	21/9	19/9
Hackbridge & Hewittic	5/-	15/-		30	23*	7 13 3	16/-	13/6
Head Wrightson	£1	143/9x.d.	−1/-	20	22½	3 2 6	146/3	112/6
Heatrae	2/-	4/6		15	15	6 13 3	4/6	4/-
Henley's	10/-	15/9		11½	11½	7 6 0	17/-	15/3
Holophane	5/-	26/3		30	30	5 14 3	26/3	17/-
Hoover	5/-	44/-	+1/-	50	50	5 13 9	44/-	24/9
I.C.I.	£1	43/9		10	10	4 11 6	46/6	37/9
Intl. Combustion	5/-	26/6		20	22½	4 5 0	30/-	20/-
Johnson & Phillips	£1	28/9	−9d	15	10	6 19 3	34/6	28/-
Lancashire Dynamo	£1	45/-		11	11	4 17 9	45/-	36/9
Laurence, Scott	5/-	17/3	+3d	15	15	4 7 0	19/9	13/9
Lister, R. A.	£1	33/-	−9d	10	10	6 1 3	33/9	26/9
London Elec. Wire	£1	48/6		12½	12½	5 3 0	53/9	43/-
Lucas, J.	£1	33/9		7½	7½	4 9 0	36/6	30/6
Marconi Marine	£1	33/9		10	10	5 18 6	33/9	31/-
Marryat & Scott	2/-	12/6	+3d	30	30	4 16 0	12/6	8/-
Mather & Platt	£1	62/6	−6d	15	15	4 16 0	63/9	51/3
Metal Industries	£1	27/-	+2/-	9	Nil	—	27/-	20/3
Midland Elec. Mfg.	£1	48/9		12½	12½	5 2 6	48/9	45/-
Morphy-Richards	4/-	18/6	+1/9	50	50	4 6 6*	18/6	11/9
Murex	£1	79/6		20	20	5 0 9	79/6	65/-
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/1
Oldham & Son	1/-	2/6		20	17½*	7 0 0	2/6	2/3
Parnall (Yate)	5/-	7/6		12	12	8 0 0	8/9	5/9
Parsons, C. A.	£1	68/9	+1/3	10	8⅛*	—	71/3	50/6
Plessey	10/-	86/3	+3d	27½	30	3 9 6	86/3	61/-
Pye "A" Deferred	5/-	19/3		12½	12½	3 5 0	20/-	15/9
Reyrolle	£1	102/6		16½	17½	3 8 3	110/-	90/-
Rheostatic	4/-	9/-		18½	12½*	5 11 0	10/-	8/9
Richardsons Westgarth	5/-	19/-x.d.		16⅜	16⅜	4 7 9	20/-	17/-
Scottish Cables	4/-	17/3x.d.		27½	27½	6 7 6	19/3	15/-
Simon-Carves	5/-	33/9		28½	20*	2 19 3	33/9	26/-
Smith (England), S.	4/-	15/-x.d.		17½	17½	4 13 3	15/9	13/-
Southern Areas	£1	18/9		7½	7½	8 0 0	20/-	13/9
Strand Elec.	5/-	7/3		15	15	10 6 9	8/-	7/3
Sturtevant	5/-	23/-		15†	15†	3 5 3†	27/-	23/-
Sun Elec.	£1	43/9		20	25	11 8 6	43/9	43/9
Switchgear & Cowans	5/-	14/3		25	25	8 15 6	15/6	13/6
Taylor Tunnicliff	5/-	12/9		15	15	5 17 9	13/9	11/9
T.C.C.	10/-	40/-		25	25	6 5 0	40/-	35/-
T.C. & M.	£1	25/-		8½	8½	6 16 0	31/-	24/6
Telephone Mfg.	5/-	6/3	−9d	10	10	8 0 0	8/-	6/3
Telephone Rentals	5/-	11/9		12½	12½	5 6 6	12/6	10/3
Thompson (John)	5/-	32/6	−6d	25	25	3 17 0	37/-	29/3
Thorn Elec.	5/-	25/9	+1/3	15	15	2 18 3	26/3	16/3
Thornycroft	£1	28/9	−1/3	15	12½	8 14 0	37/6	28/9
Tube Investments	£1	66/3		22½	15*‡	4 10 6	68/9	58/3
Vactric	5/-	21/3		17½	25	5 17 9	23/9	12/9
Veritys	5/-	9/-		12½	12½	6 19 0	9/3	8/3
Walsall Conduits	4/-	15/-x.d.		20	20	5 6 9	15/-	11/-
Ward & Goldstone	5/-	53/9	−1/3	30	35	3 5 0	56/3	36/9
Watford	2/-	6/6		25	25	7 13 9	6/9	6/3
Westinghouse	£1	40/-		18	9‡	4 10 0	41/3	36/-
West, Allen	5/-	17/9	+3d	15	15	4 4 6	17/9	12/3
Wolf Electric	5/-	11/6	−6d	20	20	4 7 0*	13/6	8/9

Southern Areas

An 8 per cent yield is shown by Southern Areas Electric £1 shares which, at 18s 9d, stand 5s above the price ruling at the start of this year, but still about 10s below the quotations recorded at times last year. Results for 1956 showed a moderate improvement on those of the previous year, and the net surplus of £35,400 (excluding special items) provided for the maintenance of a 7½ per cent dividend (as before) on the £783,000 ordinary capital. At the annual meeting, the chairman reported a 10 per cent improvement in orders on hand, as compared with the position a year ago, but was cautious about making predictions in the light of the latest wage award and of continued restrictions on business. On the longer view he expects the manufacturing members of the group to share in the continuous growth of the demand for electricity and engineering equipment.

Ever Ready

Ever Ready (Great Britain) 5s shares moved up further to a new peak of 39s 6d after the appearance of the full report for the year ended last March. In his review circulated with the accounts, the chairman is able to report record figures for sales, both at home and abroad, and for earnings. Net profit of the group (after a larger tax charge) improved by some £14,000 to £893,000, which enables the company to raise the rate of the ordinary dividend from 35 to 37½ per cent while leaving approximately two-thirds of the surplus to be retained for the purpose of financing maintenance and development expenditure. Speaking of the outlook for the current year, the chairman says that a satisfactory start has been made, although the continuously rising trend of costs makes it increasingly difficult to maintain profit margins. In connection with the coming share-for-share scrip issue, he advises shareholders not to assume that the doubling of the issued ordinary capital means necessarily any increase in the amount of the dividend. At the present rate, the 5s shares are on a yield basis of approximately 4¼ per cent. During last year the financial resources of the group were augmented by an issue of £1½ million 5¾ per cent debenture stock.

REPORTS and DIVIDENDS

Scottish Cables, Ltd.—The report and accounts for the year to 31st March last now issued confirm the preliminary figures given in our issue of 14th June. In his review of the year, Mr. W. Fraser (governing chairman) says that extensions to the administrative offices and the building and equipping of the new factory for the production of plastic cables have made good progress and production in the factory was commenced towards the end of April. They are still awaiting delivery of certain items of plant and do not expect to receive the full benefit from this new factory until the latter part of the current financial year. They are also planning to proceed immediately with new laboratories and technical offices.

Despite the difficult trading conditions and a decrease in the available business in the home market, particularly from the Electricity Boards, the works operated at full capacity throughout the year and achieved a record output both in volume and value. Exports showed a marked increase over the previous year. The sharp reduction in the copper price, coupled with an increase in the cost of aluminium, has considerably reduced the competitive margin in favour of the use of aluminium. There is, however, still a marked advantage in the larger sizes of underground distribution cables and they continue to supply large quantities of these cables with aluminium conductors. Referring to the training of technical personnel, Mr. Fraser says that following discussions with Scottish electrical organisations a joint training scheme for vacational and post-graduate electrical engineers has been formulated and initial recruitment to the scheme, which is operated under a company known as the Scottish Electrical Training Scheme, Ltd., has been very encouraging. The results of their associated company in South Africa for the year ended 30th June, 1956, were again satisfactory. The current year has started well and they have full order books.

The Ever Ready Co. (Great Britain), Ltd.—The annual meeting will be held on 10th July. In his review of the past year, which has been circulated with the report and accounts, Mr. E. N. Rowbotham (chairman) says that sales and earnings were again increased and were the highest since the inception of the company. Sales of products abroad increased substantially during the period and again new record figures were set up although difficulties were encountered in many markets due to the dislocation caused by the Suez crisis. This expansion has been made possible by the increase in output contributed by the two new factories in the Midlands and Eastern counties, both of which came into production last autumn. Their wholly owned subsidiary, Cramic Engineering Co., Ltd., has again shown increased turnover and profit. The subsidiary companies on the Continent have continued the process of reorganisation referred to last year and have achieved considerable expansion of business. After referring to the proposed capitalisation of reserves the chairman says that the use of equipment employing semiconductors is developing steadily and the dry battery will be used increasingly as a source of power for such devices. They have developed a range of "power packs" especially for use with equipment employing transistors. The current trading year has started satisfactorily but in common with industry generally they are finding it increasingly difficult to maintain profit margins in the face of continually rising costs.

The Lightfoot Refrigeration Co., Ltd.—The annual meeting was held on 18th June, Mr. K. Lightfoot (chairman) presiding. In his circulated statement the chairman said that during the first half of 1956 their remaining contracts for rearmament engineering work were completed and by the end of the year the whole of their works capacity was fully engaged in the manufacture of refrigerating plant and equipment, the invoiced value of which showed an increase of over 35 per cent as compared with the previous year. They started the year under review with a well-filled order book, and this was maintained throughout the year, the increased output being balanced by the flow of orders received so that they opened the present year's trading with a similar satisfactory volume of orders in hand.

The Southern Areas Electric Corporation.—The annual meeting was held on 19th June. In the course of his speech Lord Gridley (chairman), in referring to the subsidiary undertakings, said that the plastics works at Birmingham suffered a substantial loss. It was their experience that some of their competitors quoted prices which could hardly leave any reasonable margin of profit. By declining unsuitable business and giving attention to technical developments and economical production they expected to show improving results from this subsidiary. The Gillott and New Day undertakings were again seriously affected, not only by the continued financial stringency, but even more by the hire purchase restrictions and continued heavy purchase tax. There had been signs this year of a renewal of demand for the products of these two subsidiaries and, if this continued, improved trading results should follow.

The Ross Courtney, Carrick, Globelite, Pan, Tyer and Mawdsley undertakings were showing satisfactory progress and profits. Extensions at the Mawdsley's works at Dursley would be completed during this year. Output fell a little while tool equipment was being transferred from the old shops to the new extensions, but they expected that this would be more than overtaken before the year ended. With regard to the future, although orders in hand were 10 per cent more than they were a year ago the hampering restrictions remained and a further wage award became fully operative on 27th May. Whether it would be possible to cover this increase in cost remained to be seen.

Walsall Conduits, Ltd.—The main figures in the accounts for 1956 were given in our last issue. In his circulated statement, Mr. A. E. Read (chairman) says that sales for the current year show an increase over the corresponding period of 1956, but the demand is not so intense. Competition is becoming keener and profit margins lower, especially in the export trade. Many countries are rapidly becoming highly industrialised and now manufacture goods formerly purchased from the company. The directors are, however, considering ways and means of solving this problem. The growing demand for their products is straining production capacity to the limit and they are now planning extensions to the West Bromwich works to enable them to cope with the situation.

Vactric, Ltd., reports that, including £34,954 profits arising from pre-acquisition trading of new subsidiaries, the group profit for the year to 20th March last is £746,882, as compared with £663,949 for the preceding 53 weeks. After meeting all charges, including £316,024 for taxation, the net profit is £249,632 (against £248,696). It is proposed to pay a final dividend of 15 per cent, making 25 per cent for the year. For the previous period there was a single payment of 17½ per cent. After writing off £99,466 from investments in subsidiaries (after capitalising £291,932), the balance carried forward is £197,543 (against £122,416 brought in).

Enfield Rolling Mills, Ltd.—In connection with the issue to stockholders of 1,050,000 £1 ordinary shares at 30s each, approximately 98 per cent of the 1,036,666 shares allotted were accepted. Applications for excess shares have been scaled down.

J. Stone & Co. (Holdings), Ltd., reports a group profit for 1956 of £1,072,085, as compared with £1,274,071 for 1955. Taxation absorbs £508,651, leaving a net balance of £563,434 (against £647,438). To this is added £1,082,295 brought in and other income of £243,707, making

£1,889,436 available. Reserves receive £568,707. The ordinary and "A" ordinary dividend for the year is maintained at 16 per cent with a final payment of 12 per cent, and in addition it is proposed to make a special distribution of 2 per cent out of realised capital profits. The balance carried forward is £1,108,921.

Heatrae, Ltd.—The accounts for the year to 28th February last show a trading profit of £46,194, as compared with £46,769 for 1955-56, and after meeting all charges, including £14,100 for taxation, the net balance is £14,161 (against £11,906). The dividend for the year is unchanged at 15 per cent and the balance carried forward is £42,214 (against £33,228 brought in).

In his circulated statement, Mr. C. H. Smith (chairman) says that the extension to the buildings referred to in the 1956 report is now in full occupation. The turnover for the year established a new record, and showed a substantial increase on the previous year.

Fielden Electronics, Ltd.—At the annual general meeting held recently at Wythenshawe it was announced that a major holding in the company has been purchased by Hopkinsons, Ltd., of Huddersfield. Mr. J. E. Fielden, the founder of the company, still retains a substantial shareholding in the company and will continue as chairman and managing director. He explained that the new association with Hopkinsons would provide the necessary finances for the continued expansion of the company.

E. K. Cole, Ltd., are paying a final dividend of 10 per cent on the ordinary stock, making 17½ per cent for the year (same). The net profit of the group for 1956-57, after providing for depreciation and taxation and bringing in £61,000 taxation reserve no longer required, amounted to £359,074 (against £328,733).

Unidare, Ltd.—Details of the company's proposed new factories in Northern Ireland were given at the annual meeting held in Dublin on 20th June. The chairman, Mr. C. O. Stanley, C.B.E., said that a new factory was being built in Bessbrook, Co. Armagh, for Bessbrook Products, Ltd., the company in which they had taken a quarter interest with Pye, Ltd., Pye (Ireland), Ltd., and Ranco, Ltd. This company was formed to manufacture certain electrical products, a large proportion of which would be used by the group forming the company. The management of Bessbrook Products would be undertaken by Unidare, Ltd., which would also supply the new company with much of its raw material.

Dealing with Unidare Engineering, Ltd., Mr. Stanley said that in order to secure more business in Northern Ireland for certain of the company's products, including power transformers, overhead conductors, steel-cored aluminium and steel wire products, a branch company entirely owned by Unidare, Ltd., had been formed. Temporary premises had been obtained in Portadown, and a new factory of some 20,000 sq ft would be built.

Following the recent agreement with Reynolds International, Inc., the new factory for aluminium foil and extrusions was scheduled to start in July. Three infra-red radiant heaters were now in line production.

Mr. Stanley, dealing with trading generally, said that the future was far from clear. There was considerable talk about the common European market, but industrialists should reserve their opinions until they had a far greater knowledge of the facts.

The turnover for the year showed a gain of over £200,000, owing largely to increased export business which amounted to over £500,000. Unfortunately, export business brought a much smaller return than home sales, so that the net profit for the year was £110,213, as compared with £123,758 for the previous year. An ordinary dividend of 10 per cent is being paid.

Allen West & Co., Ltd.—An extraordinary general meeting has been called for 9th July to consider resolutions for increasing the capital to £2,500,000, capitalising £526,500 of the reserves and unappropriated surplus, and distributing to members three fully paid 5s shares for each £2 10s of ordinary stock.

W. H. Allen, Sons & Co., Ltd.—In his statement to be presented at the annual meeting on 17th July Mr. W. K. G. Allen says that the past year's output was a record one. Orders are sufficient to keep the company fully occupied for the next two or three years. The net profit for 1956 was £451,106 (against £423,844) and the dividend is 10 per cent.

The General Cable Manufacturing Co., Ltd., has declared an interim dividend of 12 per cent (unchanged).

J. & E. Hall, Ltd., are paying an unchanged interim dividend of 2½ per cent.

Aron Electricity Meter, Ltd.—The net profit for the year to 31st March last is £63,193, as compared with £62,873 for the previous year. The dividend for the year is maintained at 15 per cent.

Marco Refrigerators, Ltd., has announced an interim dividend of 2½ per cent (unchanged).

Bankruptcies

A. Le'N. Williamson, Sandringham Hotel, Hope Road, Shanklin, I. of W., hotel proprietor and electrical engineer.—Last day for receiving proofs for dividend 30th June. Trustee, Mr. R. G. B. Booth, 21, The Avenue, Southampton.

G. E. Loughlin and **G. E. Pickles,** lately carrying on business in co-partnership under the style of Central Heating, Plumbing & Electrical Co., as heating, plumbing and electrical engineers, at 45, Seaton Street, Hull.—First meeting to-day (Friday), at the County Court offices, 62, Paragon Street, Hull. Public examination 8th July at the Guildhall, Hull.

L. L. O'Connor, trading as Paragon Electrical, 27, Wellington Square, London, S.W.3, electrical and radio contractor.—Supplemental dividend of 7/32d in the £, payable at Bankruptcy Buildings, Carey Street, London, W.C.2.

E. Vasey, 21, Bridge Road, Bishopthorpe, York, electrician.—Supplemental dividend of 4s 5½d in the £, payable on and after 5th July at the Official Receiver's office, 3rd Floor, Pearl Chambers, East Parade, Leeds, 1.

Liquidation

Diamond Motors (Wolverhampton), Ltd., electric truck manufacturers.—Winding up voluntarily. Liquidator, Mr. L. H. Shipton, c/o Poppleton & Appleby, 31, Lloyd Street, Manchester, 2, appointed 7th June.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 5th July:—

POLYCLAD. No. 761,084. Class 9. Electric accumulators.—S.A.F.A. Soc. Anon. Fabrica Accumulatori, Milan, Italy. Address for service, c/o J. A. Kemp & Co., 9, Staple Inn, London, W.C.1.

GOLTOP. No. 761,348. Class 9. Transistors, germanium diodes and other semi-conducting devices.—Pye Industrial Electronics, Ltd., Exning Road, Newmarket.

SYNTACTOR. No. 761,780. Class 9. Electrical apparatus for controlling the synchronous running of electric motors by means of changes in electric current.—Contactor Switchgear, Ltd., Moorfield Road, Upper Villiers Street, Wolverhampton.

CIVIC. No. 762,503. Class 9. Radio and television instruments and apparatus and parts; and electrical apparatus and instruments.—Civic Radio Services, Ltd., 3, Easy Row, Birmingham, 1.

Nos. 762,971 and 762,972 (design). Class 9. Automatic voltage regulators, automatic voltage stabilisers and variable voltage transformers.—Claude Lyons, Ltd., 76, Old Hall Street, Liverpool, 3; and Valley Works, 4-10, Ware Road, Hoddesdon, Herts.

HEALTH-MASTER (design). No. 761,779. Class 10. Electric infra-red heating apparatus and electric ultra-violet light apparatus and combinations of these goods, all for surgical or curative purposes.—Barber Electrical Services, Ltd., 6-7, Leach Street, Birmingham, 16.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates or their functions do not clash with others already arranged

Monday, 1st July, to Friday, 5th July

MANCHESTER. — Institution of Electrical Engineers. Summer meeting.

Wednesday, 3rd July

MANCHESTER. — Engineers' Club, Albert Square, 7 p.m. A.S.E.E. Manchester Branch. "Exhibitions and Displays," by D. V. Durling.

SOUTHAMPTON.—I.E.E. Southern Centre. Summer meeting. Visit to Southampton Docks and Ocean Terminal.

Friday, 5th July

LONDON.—Savoy Hotel, W.C.2. 12.30 for 1 p.m. Scientific Instrument Manufacturers' Association. Annual luncheon.

Saturday, 6th July

HARWELL.—A.S.E.E. Oxford, Reading and Districts Branch. Visit to the Atomic Energy Research Establishment.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 3rd July from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1951

8976. Venner, Ltd., formerly Venner Time Switches, Ltd.—Emergency lighting systems for aircraft. 16th April, 1952. (778292.)

9842. United Kingdom Atomic Energy Authority.—Separation of plutonium and uranium from fission products. 23rd April, 1952. (778051.)

1952

22835. Sparcatron, Ltd.—Methods and apparatus for working electrically conductive materials by electro erosion or electrolysis. 23rd October, 1953. (778053.)

23170. Accumulatoren-Fabrik Akt.-Ges.—Electric accumulators. 11th August, 1954. (778054.)

24221. Hartridge, L., and Tyers, P. D.—Control of electric luminous discharge lamps. 21st December, 1953. (778293.)

25274. Electric & Musical Industries, Ltd.—Generation of image signals for colour television. 29th September, 1953. (778179.) 25523. Derivation of colour television signals. 29th September, 1953. (778180.)

1953

10215. Woods of Colchester, Ltd.—Frequency multiplication of alternating currents. 14th July, 1954. (778187.)

12678. Rogers, F. E.—Circuits for comparing the magnitudes and phases of steady-state voltages or currents in amplifying networks. 6th May, 1954. (778381.)

20469. General Electric Co.—Colour switching circuits including reflector type colour television receiver tubes. 23rd July, 1953. (777936.)

20526. United Kingdom Atomic Energy Authority.—Circuits using point type transistors. 25th October, 1954. (778133.)

22033. British Thomson-Houston Co., Ltd.—Fuel supply systems for reaction chambers. 9th August, 1954. (Cognate application 25854, 18th September, 1953.) (778361.)

24167. Ludtke, H. T.—Electric terminals. 1st December, 1954. (778285.)

26914. Electric & Musical Industries, Ltd.—Conversion of television signals, especially colour television signals. 22nd September, 1954. (778181.)

27065. Standard Telephones & Cables, Ltd.—Production of material for semi-conductors. 27th September, 1954. (778383.)

33786. Mullard Radio Valve Co., Ltd.—Electro discharge tubes. 4th December, 1953. (778384.)

34023 and 36396. Sylvania Electric Products, Inc.—Electroluminescent lamps. 7th and 31st December, 1953. (778067 and 778363.)

34341. Nicholson, C. H., and Duke, G. E.—Electromagnetic relays. 10th December, 1954. (778068.)

36078 and 36241. General Electric Co.—Semi-conductor devices. 29th and 30th December, 1953. (778362 and 777942.)

1954

1460. General Electric Co., Ltd., and Stenning, L. C.—Electric amplifiers. 6th April, 1955. (778189.)

5960. Bendix Aviation Corporation.—Electric signal generators. 1st March, 1954. (778161.)

6141. British Insulated Callender's Cables, Ltd.—Means for detecting eccentricity in insulated electric conductors. 1st March, 1955. (778071.)

8144. British Thomson-Houston Co., Ltd.—Luminescent materials. 22nd April, 1955. (778388.)

9138. General Electric Co.—Systems for magnetically recording a programme of sequential operations. 29th March, 1954. (777952.)

10486. Holland, F. W.—Electrical table lamps. 14th April, 1955. (778072.)

11749. Electric & Musical Industries, Ltd.—Stabilising circuits for electric power supplies. 22nd April, 1955. (777953.)

12227. General Electric Co., Ltd.—Bi-stable electric apparatus including saturable core inductors. 27th July, 1955. (778190.) 12229. Methods of manufacturing magnetic core structures for electric inductors. 27th July, 1955. (778191.)

13596. Middlesex Oil & Chemical Works, Ltd.—Impregnating compositions for use in electric cable manufacture. 9th May, 1955. (778216.)

15847. Cinema-Television, Ltd.—Electronic counting of objects. 27th May, 1955. (Cognate application 15848, 28th May, 1954.) (778288.) 15849. Apparatus for automatic counting. 27th May, 1955. (778289.)

16431. Negromanti, A.—Electro-thermal regulating device, particularly suitable for electrically heated plates. 31st May, 1955. (778397.)

19208. Raytheon Manufacturing Co.—High frequency travelling wave electron tubes. 30th June, 1954. (778399.)

19531. Babcock & Wilcox, Ltd.—Ultrasonic testing apparatus. 1st July, 1955. (778166.) 19532. Ultrasonic probes. 1st July, 1955. (778167.) 19533. Probe supporting means for ultrasonic testing of butt welds formed between sections of hollow cylindrical bodies such as pipes and method of testing butt welds formed between such sections. 1st July, 1955. (778168.)

20527. Automatic Telephone & Electric Co., Ltd.—Electrical plug and socket connectors. 13th July, 1955. (778080.)

21578. General Electric Co., Ltd.—Electric heating elements. 22nd July, 1955. (778224.)

21850. Electric & Musical Industries, Ltd.—Devices having windows for transmitting high frequency electromagnetic power. 7th July, 1955. (778299.)

23264. Veb Büromaschinenwerk Karl-Marx-Stadt.—Electronic calculating apparatus. 10th August, 1954. (777964.)

24848. Oak Mfg. Co.—Electric contacts and method of making them. 26th August, 1954. (778229.)

25127. General Electric Co., Ltd.—Thermal storage steam raisers. 29th August, 1955. (778230.)

28878. Westinghouse Electric International Co.—Electrical insulation. 7th October, 1954. (778234.)

30492. Link Aviation, Inc.—Electric phase difference measuring instrument. 22nd October, 1954. (778090.)

31115. C.A.V., Ltd.—Electric selector switches. 21st October, 1955. (778306.)

31697. Metropolitan-Vickers Electrical Co., Ltd.—Dynamo-electric machines. 2nd November, 1955. (778138.)

32578. Egyesult Izzolampa es Villa-Mossagi R.T.—Glow discharge switches. 10th November, 1954. (777977.)

33533. Telefunken Ges.—Travelling wave tubes. 19th November, 1954. (777979.)

34866. Ludtke, H. T.—Electrical clamping screws. 1st December, 1954. (778287.)

36840. M-O Valve Co., Ltd.—Magnetrons. 16th December, 1955. (777983.)

1955

539. Westinghouse Electric International Co.—Semi-conductor rectifying devices. 7th January, 1955. (777985.)

2304. Marconi's Wireless Telegraph Co., Ltd.—Pulsed radar systems. 11th October, 1955. (778147.)

2626. Moser-Glaser & Co. Akt.-Ges.—Construction of electric transformers. 28th January, 1955. (778149.)

2720. Aluminium Wire & Cable Co., Ltd.—Methods of making electrical and mechanical connections. 30th January, 1956. (777988.)

4499. Philips Electrical Industries, Ltd.—Transistor flip-flop circuits. 15th February, 1955. (778152.)

7159. Automatic Telephone & Electric Co., Ltd.—Cyclic allotting circuits. 21st February, 1956. (777993.)

10970. General Electric Co.—Production of penetrating ray images. 15th April, 1955. (778330.)

12556. Farland, D. H.—Methods of and apparatus for detecting electric potentials on surfaces. 29th April, 1955. (778107.)

12704. Corning Glass Works.—Electrical resistor and method of making it. 2nd May, 1955. (778108.)

13898. Philips Electrical Industries, Ltd.—Manufacture of electric incandescent lamps. 13th May, 1955. (778004.)

15402. General Electric Co.—Apparatus for exhausting electronic tubes and like envelopes. 27th May, 1955. (778009.)

16150. Haefely & Cie. Akt.-Ges., E.—Trolley wire installations. 6th June, 1955. (778337.)

16769. Western Electric Co., Inc.—Transistor-pulse amplifier circuits. 10th June, 1955. (778012.)

17574. Philips Electrical Industries, Ltd.—Cavity resonator magnetrons. 17th June, 1955. (778013.)

18338. Western Electric Co., Inc.—Method of coating cathodes for electric discharge devices. 24th June, 1955. (778339.) 19086. Circuits including transistors. 1st July, 1955. (778015.)

19637. Hazeltine Corporation.—Colour television signal modifying apparatus. 7th July, 1955. (778017.)

19840. Philips Electrical Industries, Ltd.—Cathode-ray tubes for colour television. 8th July, 1955. (778342.)

23180. Western Electric Co., Inc.—Communication systems employing gas discharge tubes. 11th August, 1955. (778022.)

23309. Mullard Radio Valve Co., Ltd.—Electrical regulating circuits. 12th August, 1955. (778111.)

24890. Kuhnke, H.—Rotary electromagnets. 30th August, 1955. (778371.)

25664. Ericsson Telephones, Ltd.—Discharge devices for electronic counting and like purposes. 7th September, 1955. (778114.)

26468. Radios Soc. Anon.—Vacuum cleaners. 15th September, 1955. (778116.)

28483. Westinghouse Electric International Co.—Lightning arrestors. 6th October, 1955. (778279.)

28619. Standard Telephones & Cables, Ltd.—Electronic plotting station for automatic plotting of one or more movable objects. 7th October, 1955. (778121.)

29341. Standard Telephones & Cables, Ltd.—Crystal production. 14th October, 1955. (778123.)

31897. Standard Telephones & Cables, Ltd.—Process for lining metallic tubes with thermoplastic material. 8th November, 1955. (778034.)

33248. General Motors Corporation.—Electric cooker. 21st November, 1955. (778036.)

33844. Western Electric Co., Inc.—Core-winding machines. 25th November, 1955. (778037.)

36728. General Electric Co.—Electric plugs. 22nd December, 1955. (778130.)

37412. Westinghouse Electric International Co.—Electrical immersion heating devices. 30th December, 1955. (778158.)

37445. General Electric Co.—Dynamo-electric machines. 30th December, 1955. (778159.)

GENERATION AND DEVELOPMENT

Higher Output in May

After the fall in electricity output in February and March, largely as a result of the abnormally mild weather experienced, there was a small increase in April and the Ministry of Power figures for May, now published, show a more pronounced upward trend. As will be seen from the accompanying table, 7,248 million kWh was generated by the Central Electricity Authority, the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board during the month, 13·6 per cent more than in May, 1956, and the total for the year so far is now 1·4 per cent greater than in the corresponding period of last year. This increased output was achieved with a smaller fuel consumption.

ELECTRICITY GENERATED AND SENT OUT FOR PUBLIC SUPPLY

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity Authority ...	3,397	67	58·0	6,676	4	6,686	6,269	22,763
North of Scotland H.E.B. ...	12	—	1·1	18	96	118	117	831
South of Scotland E.B.	222	6	0·2	431	13	444	419	1,368
Total for May, 1957	3,631	73	59·3	7,125	113	7,248*	6,805	24,962
Corres. total for May, 1956 ...	3,173	71	32·5	6,281	88	6,381	5,978	22,701
Inc. or dec., per cent	+14·4	+2·8	+82·4	+13·4	+28·4	+13·6	+13·8	+10·0
Total to date (5 months), 1957 ...	19,668	397	130·9	38,002	1,014	39,072	36,750	
Total for corres. 5 months of 1956	19,784	421	171·7	37,821	635	38,536	36,231	
Inc. or dec., per cent	−0·6	−5·7	−23·8	+0·5	+59·7	+1·4	+1·4	

* The total figure includes generation by other methods amounting to 10 million kWh.

At the end of the month the aggregate installed capacity of plant was 24,962 MW, compared with 24,779 MW at 30th April, a net increase of 183 MW. New plant installed by the C.E.A. included a 100 MW Metropolitan-Vickers set and Babcock & Wilcox boiler at Castle Donington, a 50 MW Met.-Vick. set at Nottingham H.P., a 60 MW Simon-Carves boiler at Hams Hall "C" and a 60 MW English Electric set at Wakefield "B."

During the four weeks ended 25th May 794 million kWh was generated by industry (excluding railways, transport undertakings, coal mines, gas works and petroleum refineries), making the total so far this year 4,309 million kWh (5·8 per cent increase).

New Londonderry Power Station

A twelve-acre site at Coolkeeragh, nearly four miles from Londonderry, Northern Ireland, and on the shores of the River Foyle, is now being cleared for the construction of a power station, work on which is expected to begin in the autumn. The cost is estimated at £4½ million.

Two jetties are to be constructed on the Foyle. One will serve tankers discharging oil for the generating station, and the other will be used to ship materials to, and finished products from, the Du Pont and British Oxygen factories to be built on the old Maydown airfield which is nearby. When it became known that the Du Pont Company had selected a 381-acre site at Maydown for a factory for the manufacture of synthetic rubber, it was decided to transfer the site of the proposed power station from St. Columb's Park in Londonderry City to Coolkeeragh, and to double the size originally contemplated.

Arrangements have been made between the Electricity Board and Du Pont for the supply of electricity and low-pressure steam to the new factory, which will involve piping steam a quarter of a mile to the airfield site. The Electricity Board and Du Pont will also co-operate in providing a supply of water for cooling purposes, and tunnels will be driven under the embankment of the Foyle which carries the main Londonderry-Belfast railway line.

Lines over Farmyards

North Riding (No. 2) Branch of the National Farmers' Union has called upon the Central Electricity Authority to use insulated overhead cable over farmyards. The Branch's proposal was made following a recent fatal accident to a farm worker in the York area when a metal ladder he was carrying touched an overhead line.

Zoned Rural Electrification

Addressing a meeting at Carlisle, Mr. W. S. I. Whitelaw, M.P. for Penrith and the Border (Cumberland), referred to a new zoning scheme for supplying electricity to country areas which is to be started in 1958. The parishes to be included in the first zone, he said, would be Hesket, Ainstable, Lazonby, Kirkoswald, Great Salkeld, Hunsonby, Langwathby and the greater part of Glassonby, Ousby and Culgaith. In the Carlisle district, the parishes of Dundraw, Woodside, Wigton, Waverton, and part of Holme East Waver, Bromfield, Aikton, Orton, Thursby and Westward would be dealt with.

Scottish Water Power Scheme

The Mossford (formerly Glascarnoch) power station of the North of Scotland Hydro-Electric Board recently went into commercial service. The station houses two 17,000 b.h.p., 458ft net head, 500 r.p.m., vertical Francis turbines, manufactured by the Harland Engineering Co., Ltd., Alloa, each driving a 12 MW synchronous generator of Bruce Peebles manufacture.

Amalgamation of Districts

The East Midlands Electricity Board has amalgamated the Mansfield and Worksop Districts. The new Mansfield and North Nottinghamshire District will have an area of 545 square miles and serve 106,000 consumers, the district office being at Mansfield.

OVERSEAS

Snowy Mountains Scheme

Tenders for three further major projects in the Snowy Mountains hydro-electric scheme are to be called for before the end of this year, reports the Canberra correspondent of *The Times*. The value of the contracts will be in the neighbourhood of £A100 million. The announcement was made by Sir Arthur Fadden, the acting Prime Minister, when he closed the outlet gates of the Adaminaby Dam, which will be the largest in Australia.

New Zealand Power Plan

Reuter reports from Wellington that a report issued by Mr. Goosman, the Minister in charge of the State Hydro-Electric Department, announces a power development programme covering the next thirteen years and representing an expenditure of £235 million. It provides for the construction of new hydro-electric, gas turbine and geothermal stations, including the 480 MW Benmore hydro-electric plant on the Waitaki River, South Island, which will cost £36 million. The report recommends the approval, in principle, of linking the North and South Islands by a submarine power cable across Cook Strait at a cost of about £16 million.

V.H.F. Stations for Irish Board

The Irish Electricity Supply Board has purchased a site on Monument Hill, Westport, County Mayo, for a v.h.f. radio station. It will have a radius of 70 miles. Other v.h.f. stations are to be erected at Cork and Drogheda.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Argentina.—Water and Electricity Board. 25th September. Hydro-electric power station. (E.S.B. 13854/57. Ten/26483.)*

Auchtermuchty.—Town Council. 13th July. Street lighting equipment. (See this issue.)

Australia.—Department of Civil Aviation, Melbourne. 3rd September. Radar equipment. (E.S.B. 14874/57. Ten/26386.)*

Director of Posts and Telegraphs, Melbourne. 30th July. Switching keys for telephone switchboards. (E.S.B. 14843/57. Ten/26385.)*

Burma.—Burma Purchase Board. 1st July. Electricity meters. (E.S.B. 14826/57. Ten/26372.)* Electric starters. (E.S.B. 14824/57. Ten/26370.)* 3rd July. One 200 A, 660 V oil circuit-breaker. (E.S.B. 15075/57. Ten/26436.)* 8th July. Electric furnace. (E.S.B. 15338/57. Ten/26500.)*

Chester-le-Street (Durham). — R.D.C. Repair and maintenance of electrical equipment in council houses, etc., at Sacriston. F. Bowman, Estate Office, Great North Road, Birtley.

Chile.—Oficina del Senor Comandante del Material, Ministerio de Defensa Nacional, 4th July. Radio equipment for the Chilean Air Force. (E.S.B. 15152/57. Ten/26441.)*

Durham.—County Council. Electrical installation in new Fence Houses fire station. County architect, South Street, Durham.

Essex.—County Council. Contractors wishing to tender for the contract for the renewal of the electrical installation at Clacton County High School should apply by 6th July. (See this issue.)

Formosa.—Central Trust of China, Taipei. 15th July. Electronic instruments, meters and measuring instruments. (E.S.B. 15057/57. Ten/26447.)*

India.—Director General of Supplies and Disposals, New Delhi. 2nd July. Bare copper conductor. (E.S.B. 14910/57. Ten/26388.)*

Ipswich.—Corporation. 24th July. Electrical installation in Civic College workshop extensions. (See this issue.)

Iraq.—Development Board and Ministry of Development. 5th August. Equipment for Dibis and Baghdad power stations, including transformers, substation equipment, motors, etc. (E.S.B. 14983/57. Ten/26427.)*

Longbenton.—U.D.C. 13th July. Street lighting equipment. (See this issue.)

New Zealand.—Auckland Electric Power Board. 19th July. P.v.c. aerial cable. (E.S.B. 14660/57. Ten/26348.)*

Stores Division, G.P.O., Wellington. 18th July. Audio attenuators and transmission measuring sets. (E.S.B. 14913/57. Ten/26361.)* 22nd July. Admittance and resistance-capacity bridges. (E.S.B. 14918/57. Ten/26358.)* 24th July. Three audio oscillators. (E.S.B. 14916/57. Ten/26360.)* 25th July. Oscillators. (E.S.B. 14915/57. Ten/26359.)* 26th July. Lead acid batteries. (E.S.B. 14919/57. Ten/26379.)* Frequency shift simulator. (E.S.B. 14914/57. Ten/26363.)* 1st August. Signal and noise generators. (E.S.B. 15016/57. Ten/26462.)* 31st July. Oscilloscopes. (E.S.B. 15015/57. Ten/26463.)*

Tenders will shortly be invited for 11,000, 3,300 and 400 V cables for the Wairakei geothermal project. Particulars can be obtained from Merz & McLellan, Esher, Surrey. (See this issue.)

Northern Ireland.—Belfast Royal Academy. 8th July. Electrical work in connection with the conversion of existing classrooms into laboratories. Ferguson & McIlveen, architects, 15, College Gardens, Belfast.

Down County Council. 5th July. Electrical installation in new County Council Offices in English Street, Downpatrick. J. R. W. Murland, consulting engineer, 13, Wellington Place, Belfast.

Pakistan.—Posts and Telegraphs Department, Karachi. 15th July. Voice frequency telegraph equipment. (E.S.B. 14876/57. Ten/26387.)*

Rhodesia and Nyasaland.—Bulawayo City Council. 17th July. Electricity meters. (E.S.B. 15012/57. Ten/26413.)*

Solihull.—Corporation. 8th July. Street lighting equipment. (See this issue.)

South Africa.—Stores Department, South African Railways. 19th July. Fork lift trucks. (E.S.B. 15034/57. Ten/26421.)*

Stratford-on-Avon. — Borough Council. Lighting installation, Bath-Lincoln trunk road. (See this issue.)

Uruguay.—Ministerio de Salud Publica. 9th July. Radio receivers for the blind. (E.S.B. 14171/57. Ten/26333.)*

Administracion Nacional de Combustibles Alcohol y Portland. 12th July. Armoured and rubber covered cables and accessories. (E.S.B. 14669/57. Ten/26393.)*

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aberystwyth.—Biology buildings, University College of Wales; Lucas & Pyke, electrical consultants, 25, Caxton Street, London, S.W.1.

Alperton.—Factory, offices and canteen; Mining & Chemical Products, Ltd., 86, Strand, London, W.C.2.

Ashington.—Grammar school (£150,000); county architect, County Hall, Newcastle-upon-Tyne.

Bangor.—Houses (84), Maesgeirchen estate; city surveyor, Town Hall.

Bath.—Technical college; F. Gibberd, architect, 19, The Rows, Stone Cross, Harlow, Essex.

Bexley.—Dwellings (61), Hurst Place estate; borough surveyor.

Birkenhead.—Preliminary training school and nurses' home, Upton Road; regional engineer, Liverpool Regional Hospital Board; 2, Union Street, Liverpool, 3.

Bury St. Edmunds.—Council chamber and offices (about £100,000); West Suffolk county architect, 13, Westgate Street.

Chelmsford.—Schemes for erection of houses on 47-acre site at Baddow Road, Great Baddow, and on large site at Roxwell Road, Writtle; borough engineer, Municipal Buildings, Duke Street.

Cheltenham.—Secondary modern school at Arle (£167,510); borough engineer, Municipal Offices.

Corby.—Houses (45), South Road; G. B. Blackall, clerk to U.D.C., Council Offices, Corby, Northants.

Croydon.—Factory extension; Ductwork, Ltd., Commerce Way.

Edinburgh.—Neurological unit at the Western General Hospital (£100,000); South Eastern Regional Hospital Board, 11, Drumsheugh Gardens, Edinburgh, 3.

Gateshead.—Block of flats (£373,310); G. S. Winters, borough surveyor.

Godalming.—New accommodation for staff and extensions to dining room at King George V Chest Hospital; S. G. Livock, architect, 10, Tavistock Place, London, W.C.1.

Gornal Wood.—Crematorium, for Sedgley, Dudley and Brierley Hill Joint Committee; K. R. F. Newton, clerk, Council House, Sedgley, near Dudley.

Guildford.—Factory, Woodbridge Meadows; Alfred Bull & Co., Ltd., 77, North Street.

Guisborough.—Ambulance station; county architect, Northallerton.

Havant.—Development of 48-acre site at Sharps Cross, Leigh Park, for housing; city engineer, 1, Clarence Parade, Southsea.

Hull.—New central exchange and head offices for Hull Telephones Committee; city architect, Lowgate.

Isleworth.—Houses (45), Twickenham Road; General Housing Co., Ltd., 55, The Mall, London, W.5.

London.—Reconstruction of public baths, Bow; Thomas Barrett, Sons & Partners, surveyors, 50, Pall Mall, S.W.1.

Luton.—Flats (78), New Town Street; borough architect, Town Hall.

Macclesfield.—Houses (450), Weston estate; borough engineer.

Norwich.—Multi-storey block of offices on site fronting All Saints' Green and Surrey Street; T. P. Bennett & Sons, architects, 43, Bloomsbury Square, London, W.C.1.

Pontefract.—Crematorium; A. F. Richmond, surveyor, Municipal Offices.

Reading.—Headquarters in Merchants Place (£45,000); secretary, Y.M.C.A., 30, Friar Street, Reading.

Redditch.—Works extensions; Super Oil Seals & Gaskets, Ltd., Studley Road.

Scarborough.—Boys' high school for North Riding E.C.; Grenfell, Baines & Hargreaves, architects, Guildhall Street, Preston.

Sedgefield.—Development of housing site, Durham Road; Tarran & Caller.

Sheffield.—Factory and offices, Smithfield; W. Wild & Sons (Cutlers), Ltd., 24, Bramwell Street.

Shrewsbury.—Crematorium, London Road; borough surveyor, Guildhall.

Southall.—Dwellings (36), Allenby Road; borough surveyor.

South Shields.—Factory, Sunny Terrace; Tyne Wire Rope Manufacturing Co.

Stevenage.—Factory extension; British Tabulating Co., Ltd., Letchworth, Herts.

Walthamstow.—Flats and maisonnettes (160), The Drive; borough architect.

Wellingborough.—Flats, High Street and Jacksons Lane (£20,090); Council's architect, Wellingborough, Northants.

West Ham.—Dwellings (103), Oxford Road; borough architect.

West Hartlepool.—Factory; South Durham Steel & Iron Co., Ltd.

Wilton.—Primary school (£60,000); county architect, Northallerton.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

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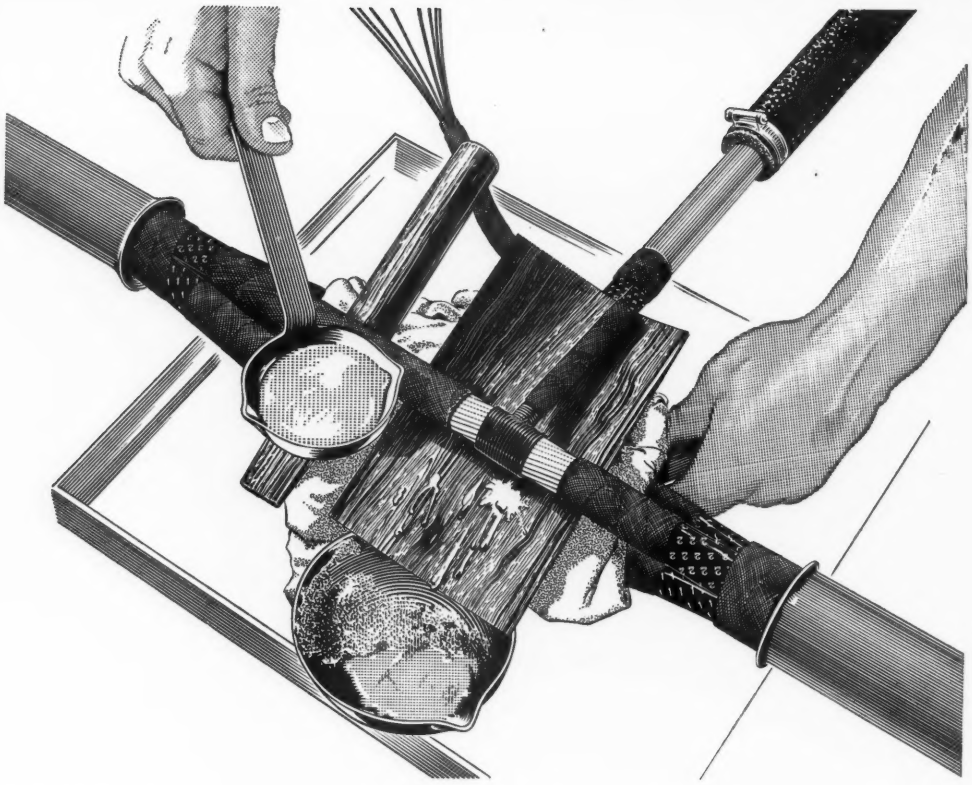

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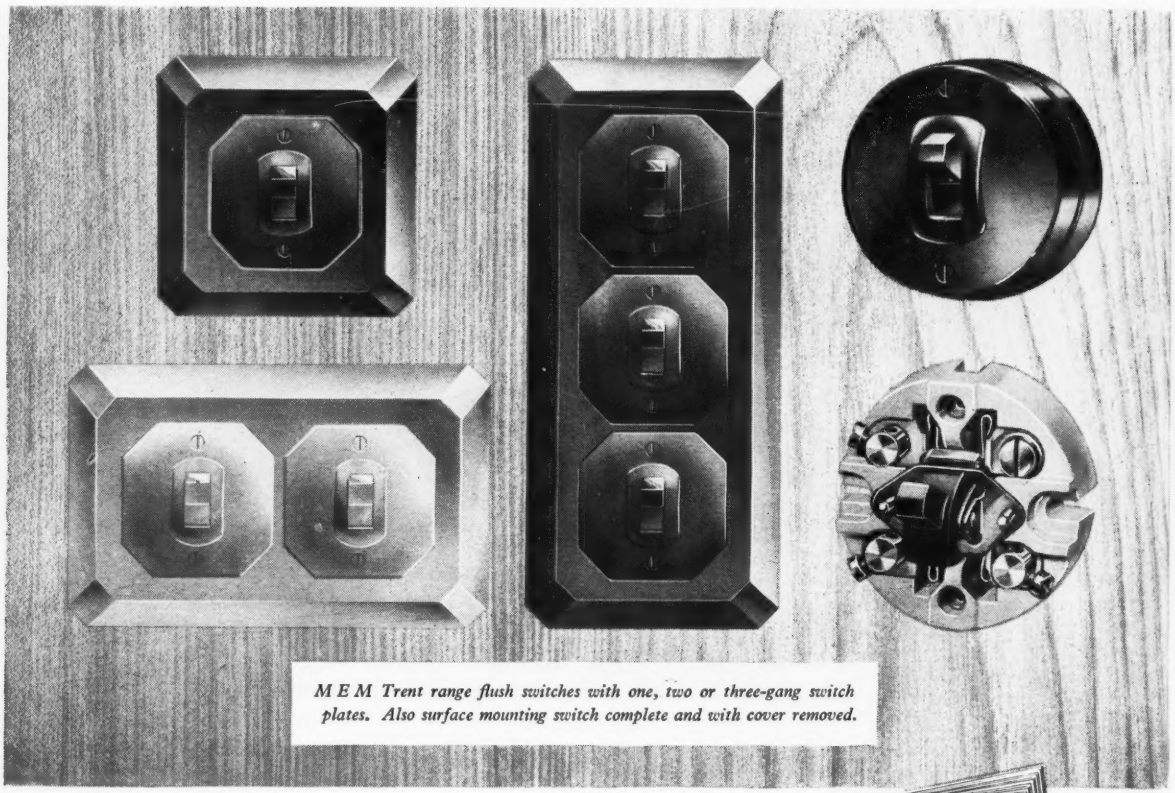

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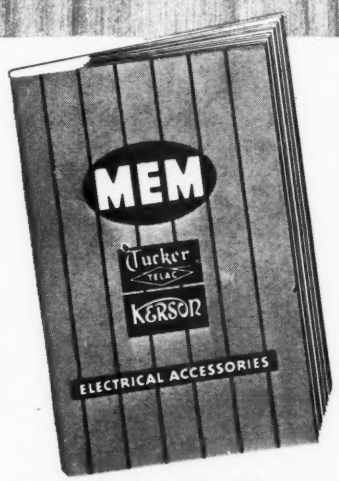

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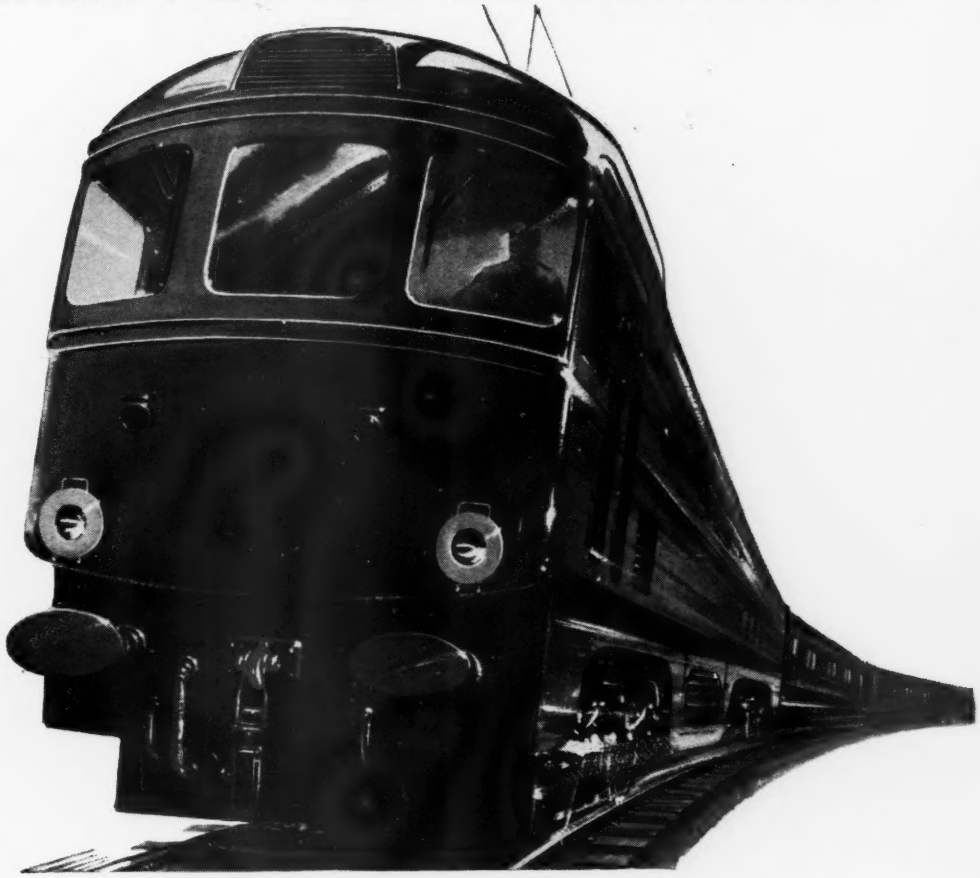

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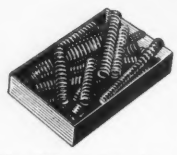
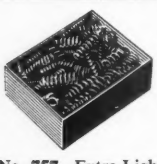
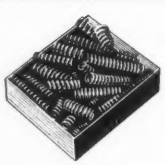


No. 760. 3 doz. Assorted Light Compression Springs. 1″ to 4″ long, 22 to 18 S.W.G., ¼″ to ½″ diam. 6/6 each.



No. 757. Extra Light Compression, 1 gross Assorted, ½″ to ⅝″, ¼″ to 2″ long, 27 to 20 S.W.G. 15/- each.



No. 98A. 3 doz. Assorted 1″ to 4″ long, ¼″ to ¾″ diam., 19G to 15G. 5/6 each.

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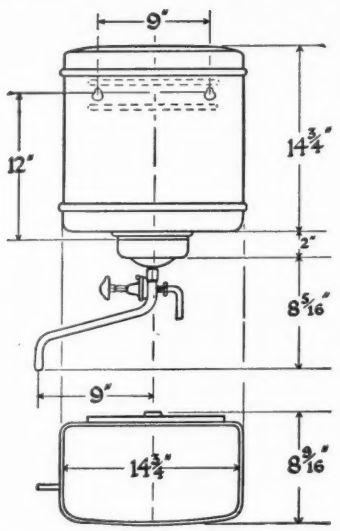

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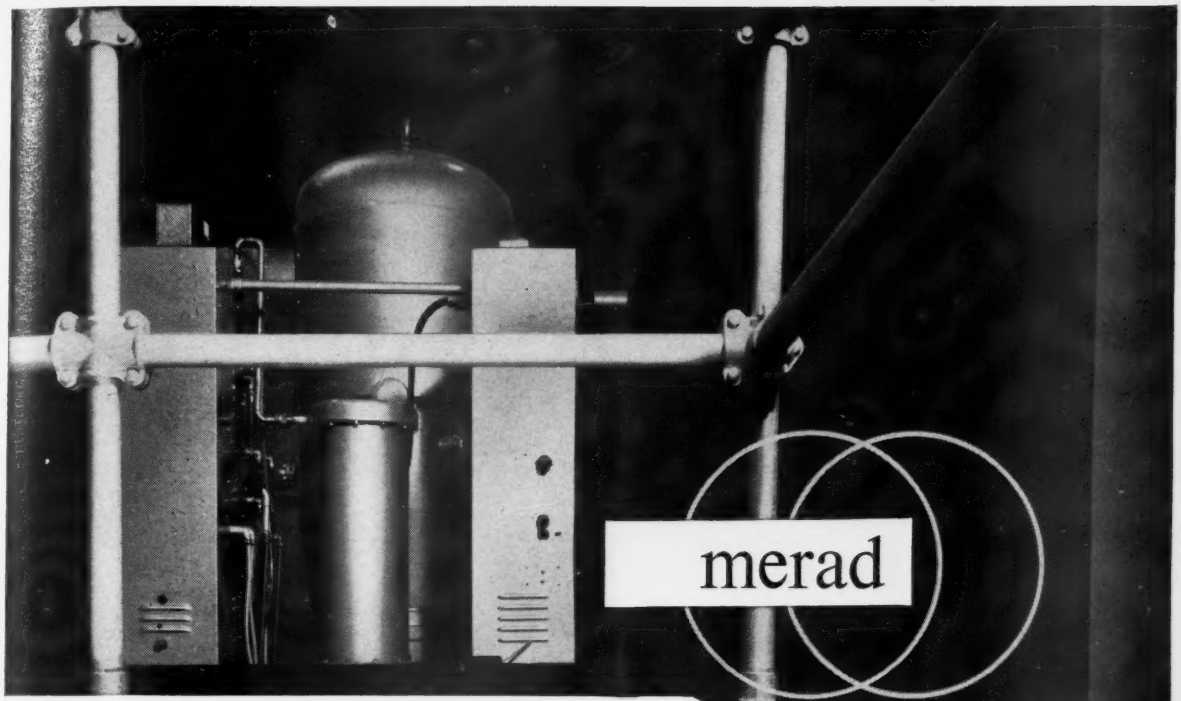

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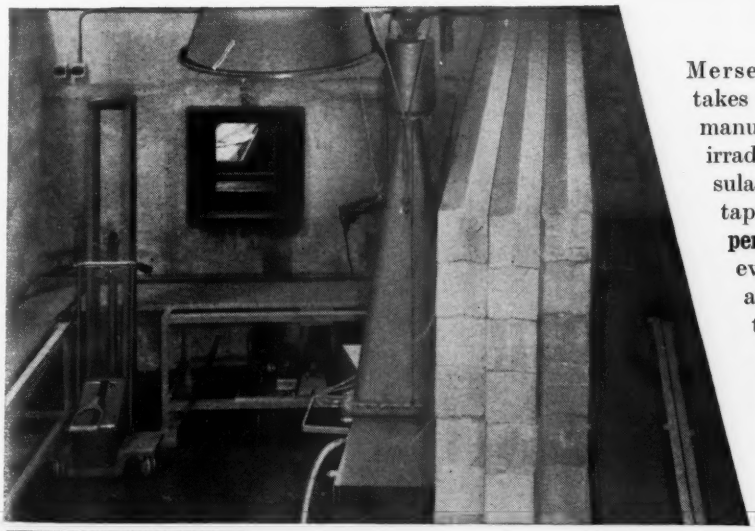

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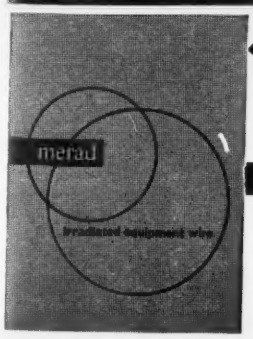

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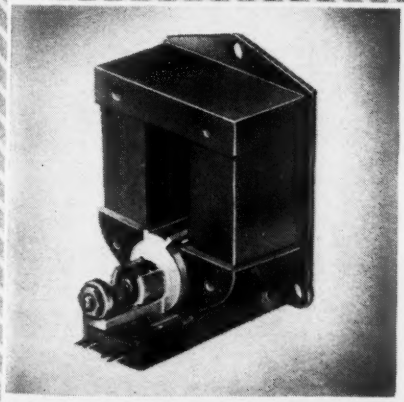

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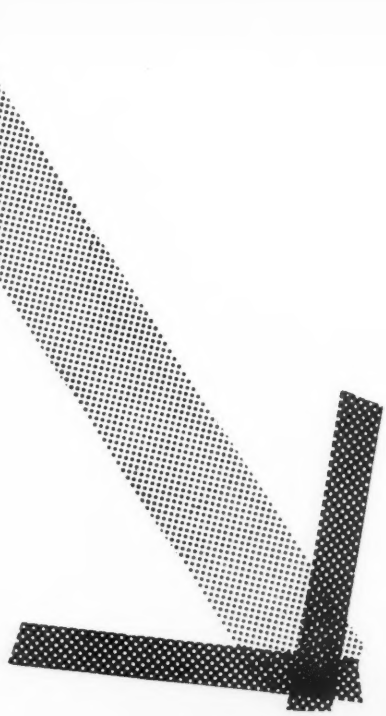

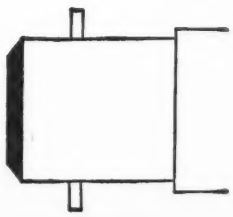

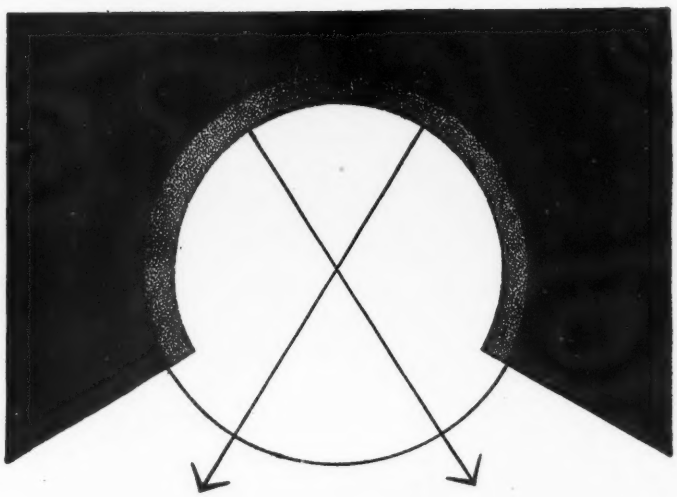

This cross-section of a "Reflectalite" tube shows the diffusing, reflecting layer of powder inside the glass, which covers approximately 240° of the circumference.

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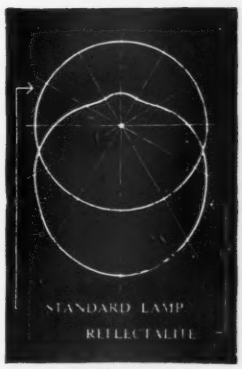

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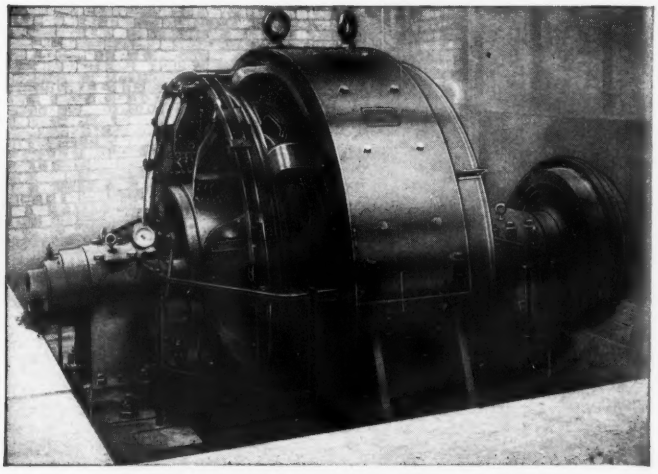

Illustrated is a 1,000 H.P. 460v. D.C. Variable Speed Mill Motor. Reconditioned and installed by T.W.W.

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1800	400/440	365	O. Protected	B.T.H.
1400	6600	365	O. Protected	B.T.H.
900	3300	485	O. Protected	L.D.M.
900	400/440	485	O. Protected	L.D.M.
750	6600	485	O. Protected	L.D.M.
400	3300	485	Protected	E.E.C.
400	400/440	485	Protected	E.E.C.
350	400/440	720	Pipe Vent	Mather & Platt
300	400/440	580	Protected	E.C.C.
300	400/440	720	Protected	Mather & Platt
250	400/440	415	Protected	Brush
250	400/440	490	S. Protected	B.T.H.
175	400/440	585	Pipe Vent	E.C.C.
155	400/440	585	S. Protected	Brush
130	400/440	1440	S. Protected	E.E.C.
120	400/440	720	Protected	Brook
110	400/440	580	S. Protected	Brook
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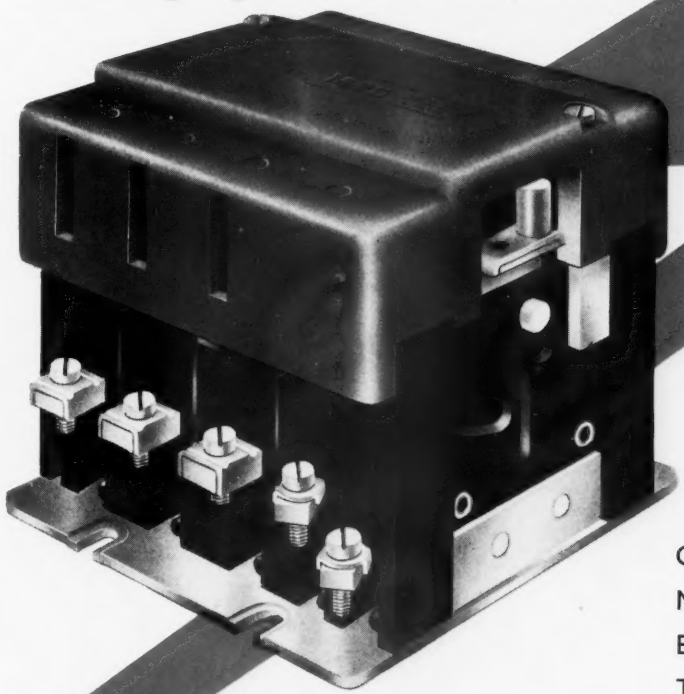

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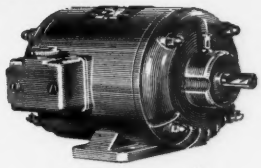

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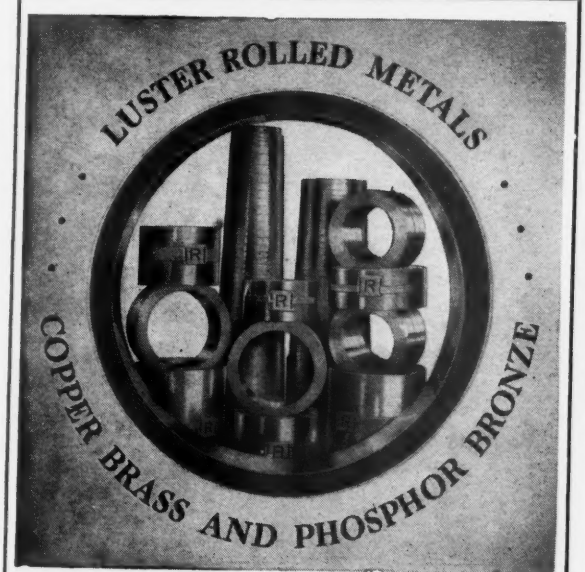

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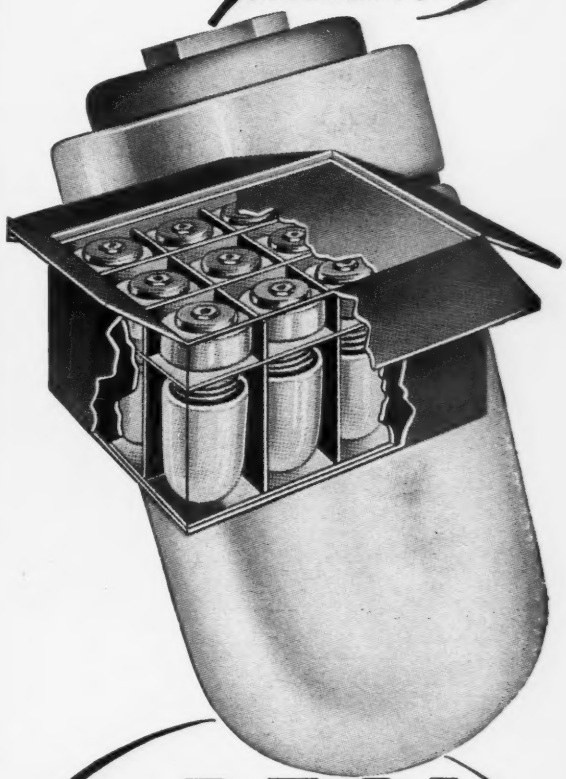

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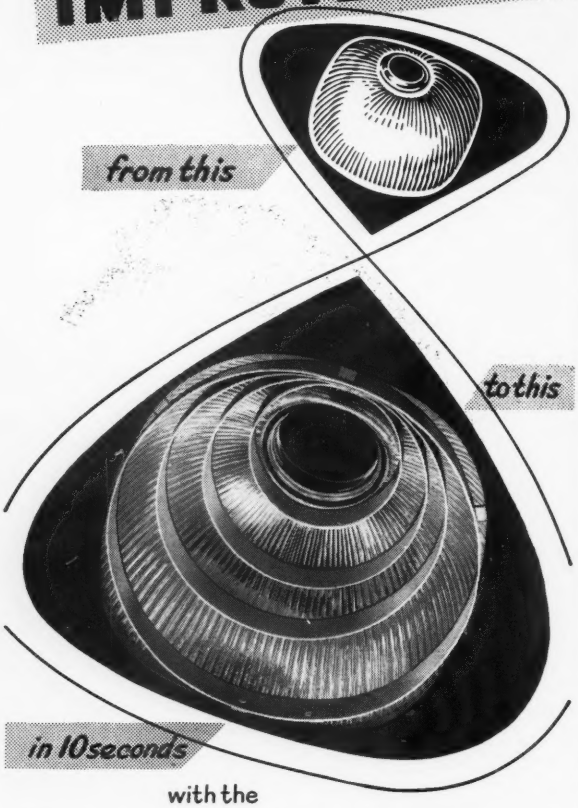

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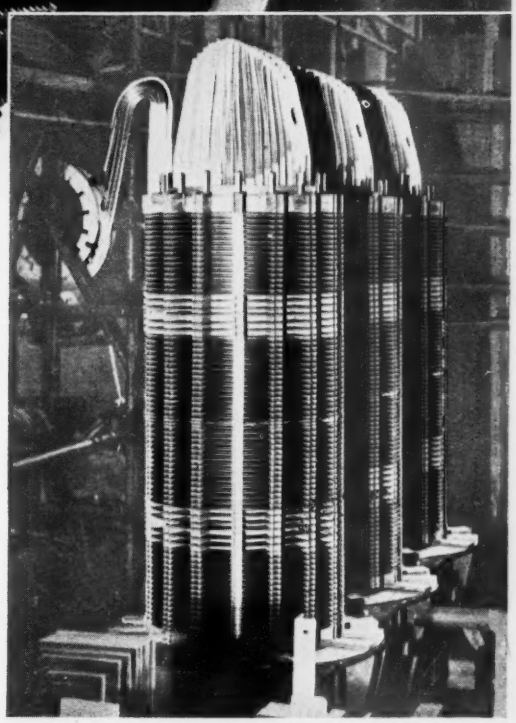

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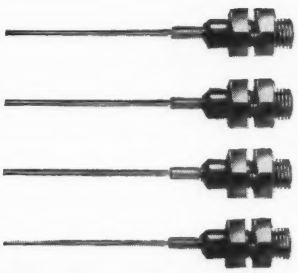

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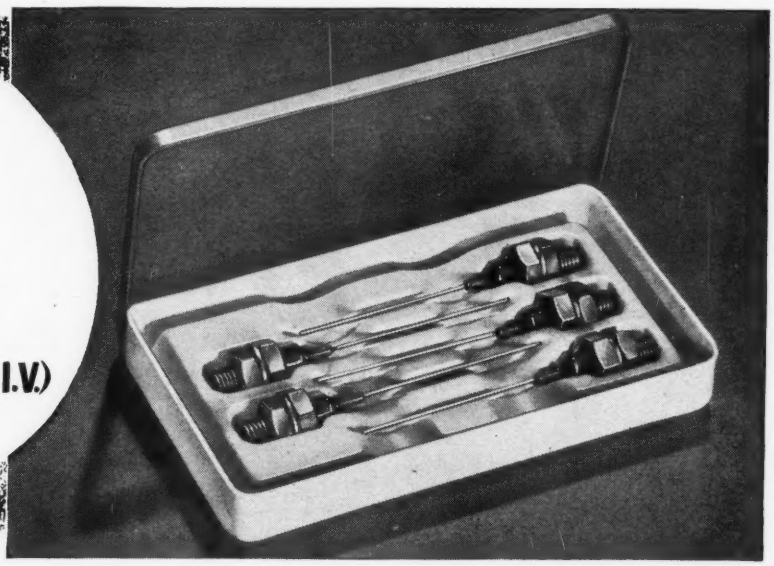

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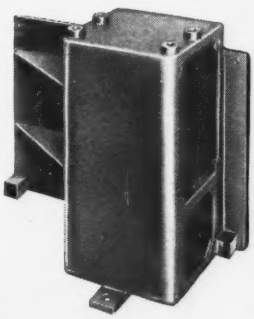

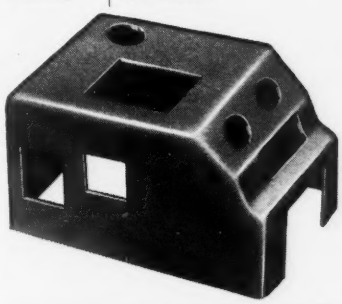

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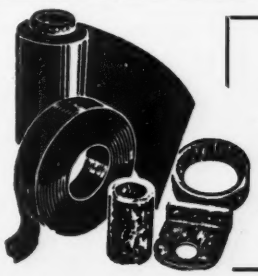

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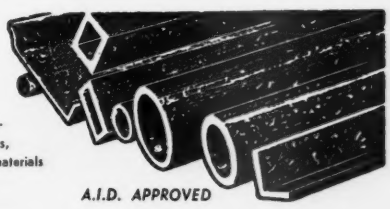

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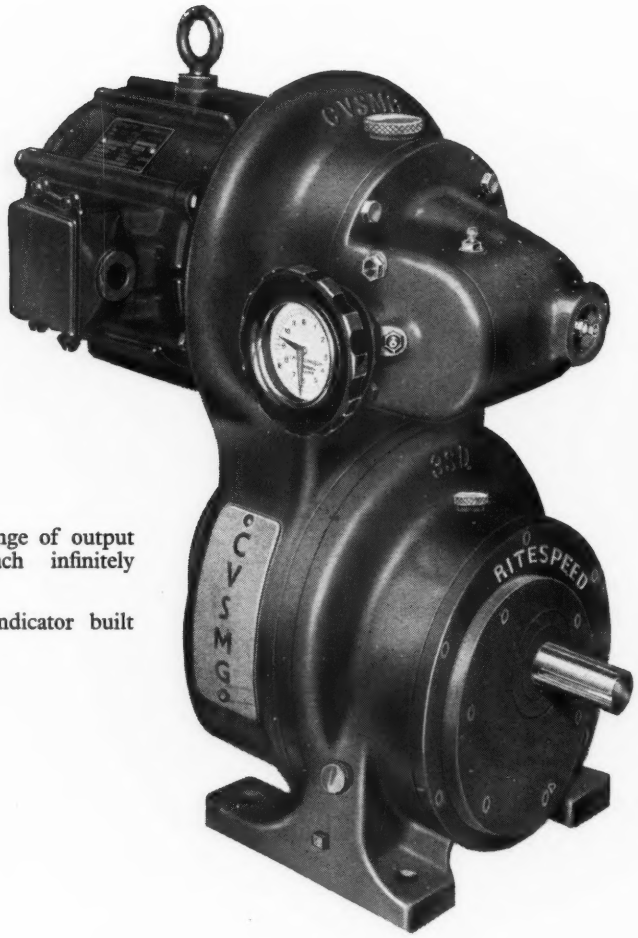

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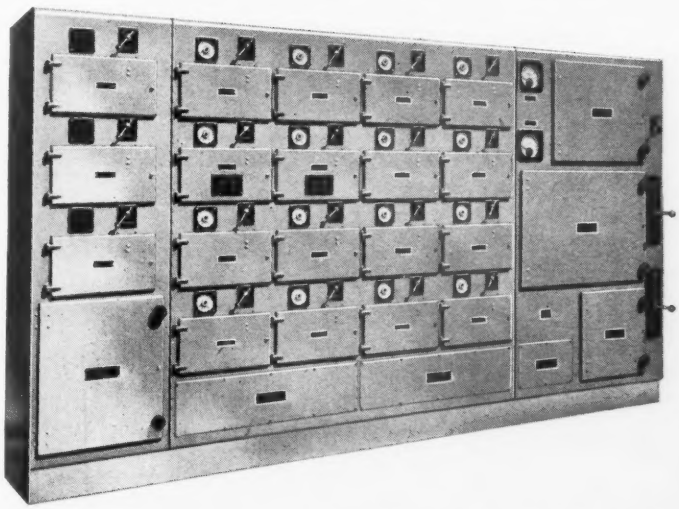
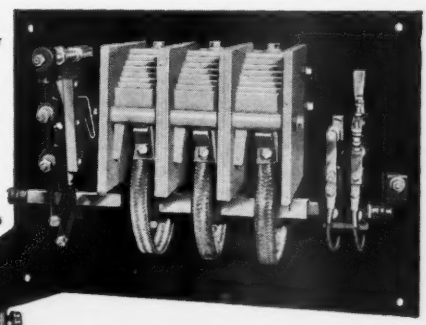


On the left illustrates a typical Multi-Motor Switchboard with busbar, fed individually isolated starter cubicles



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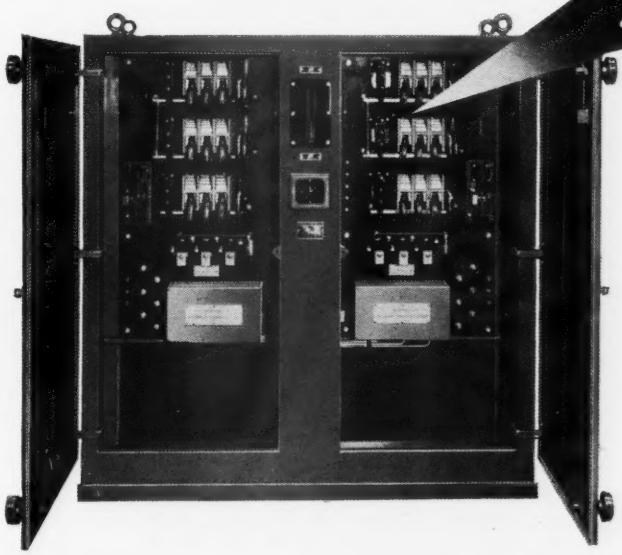

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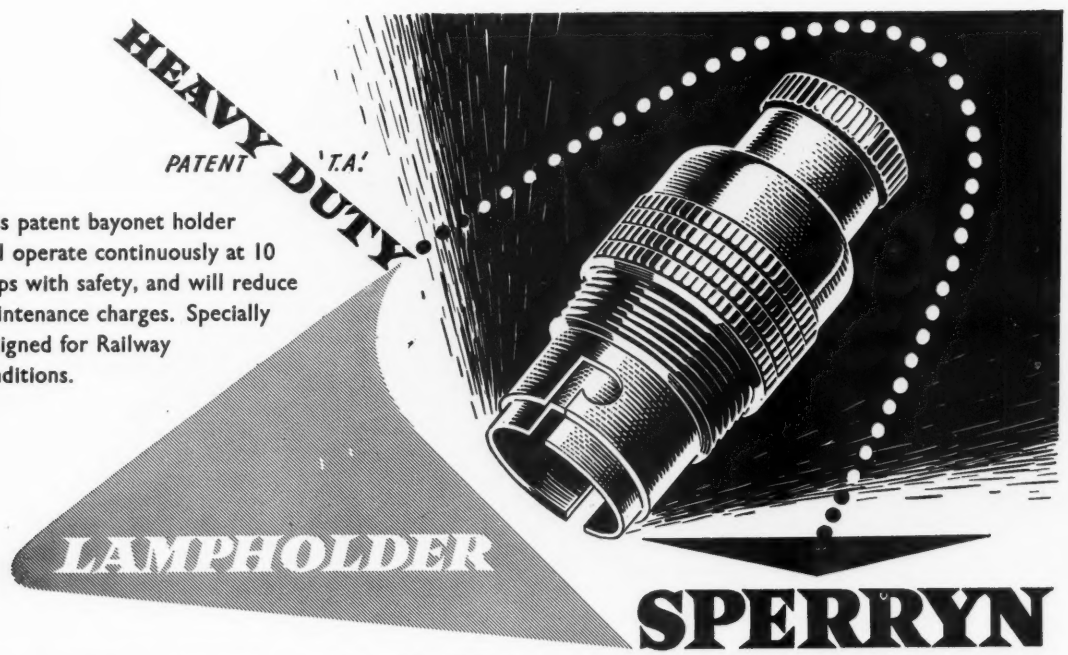
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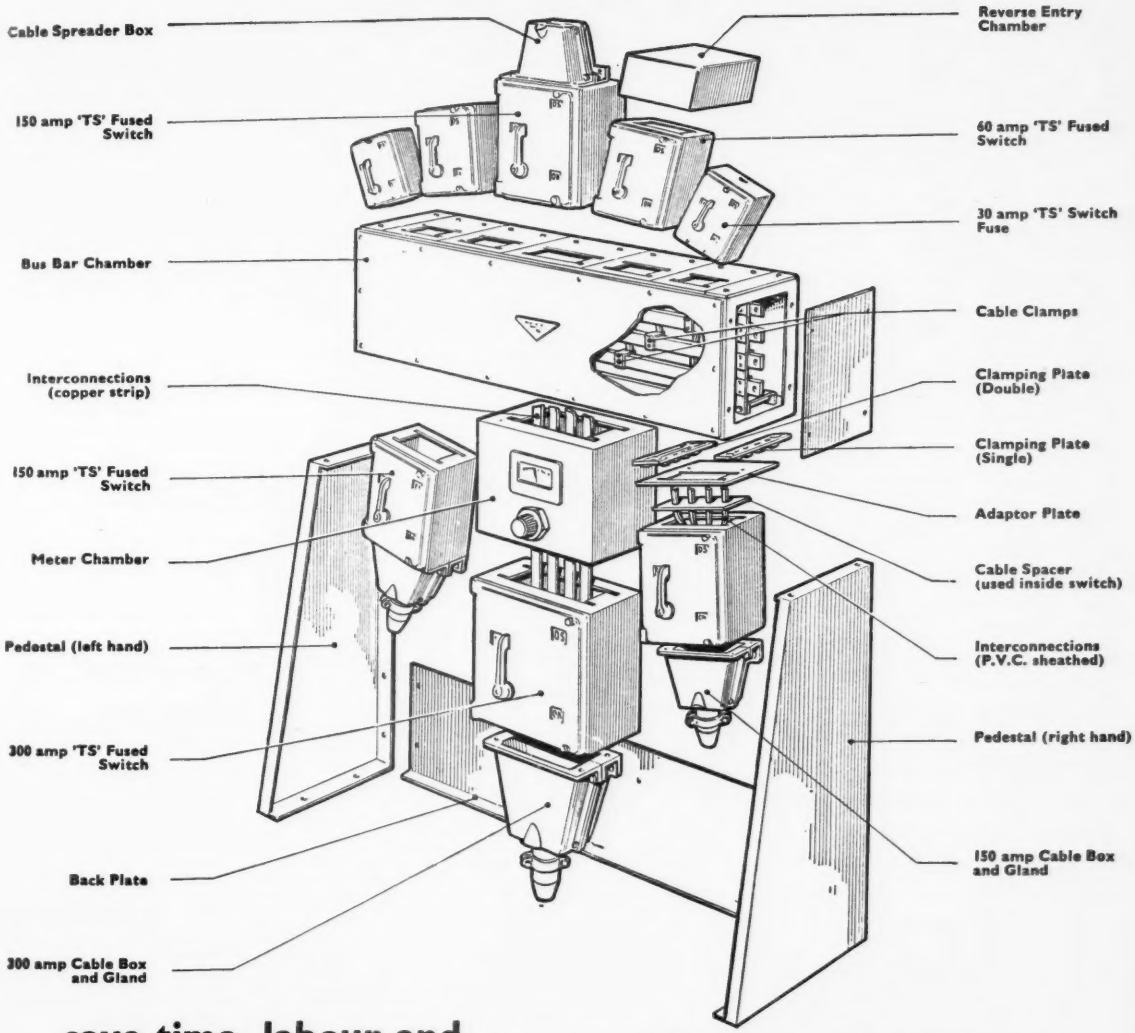

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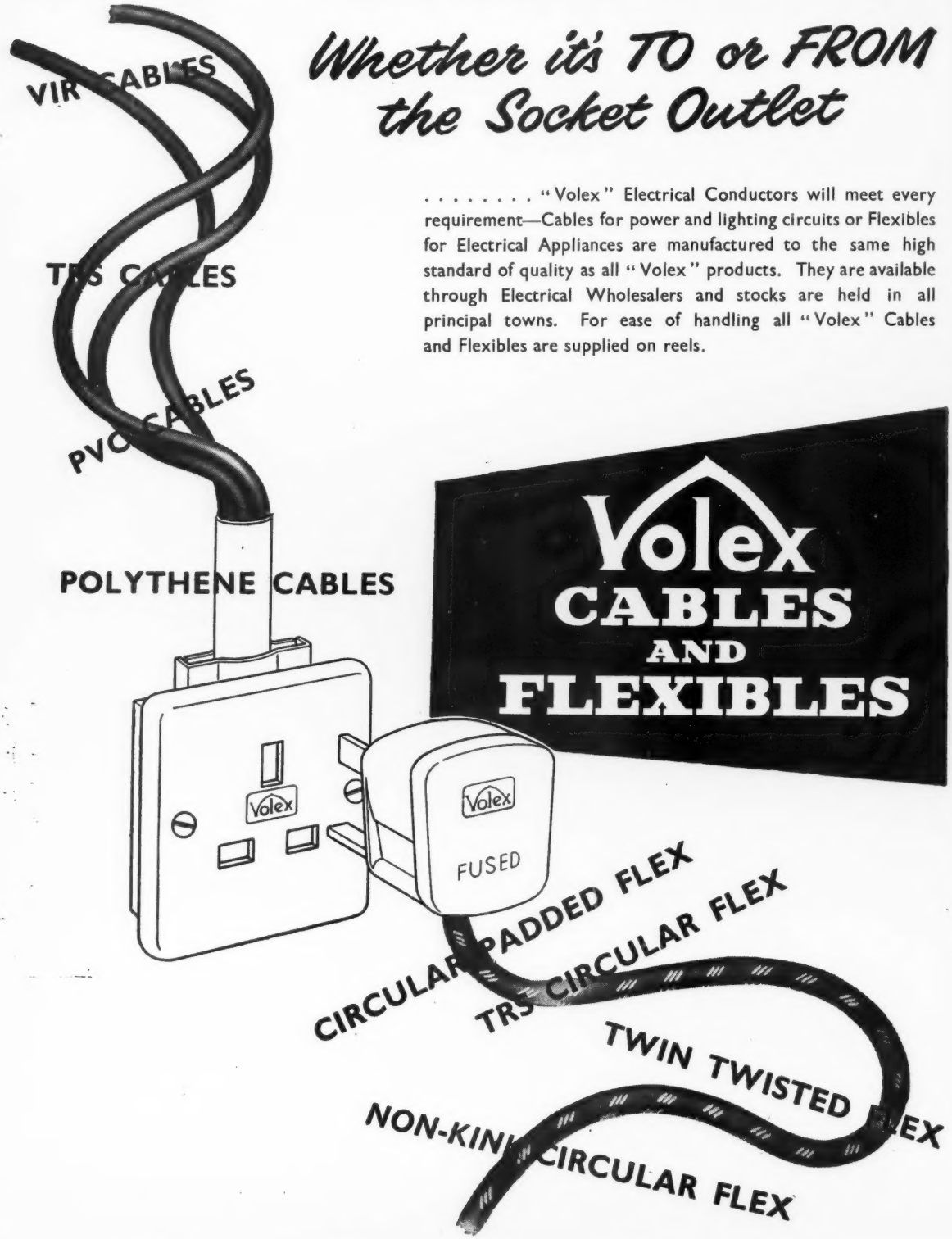

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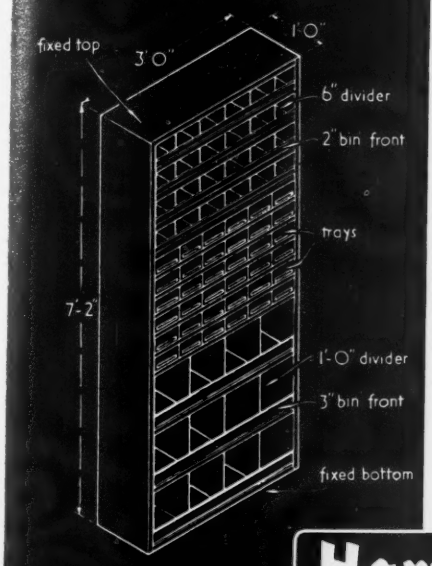

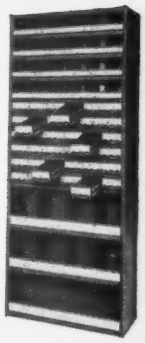

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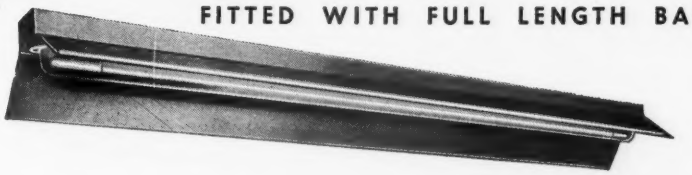

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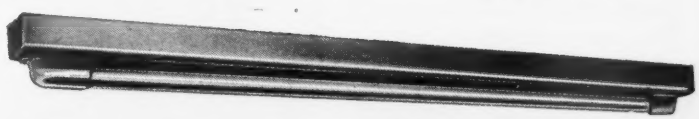

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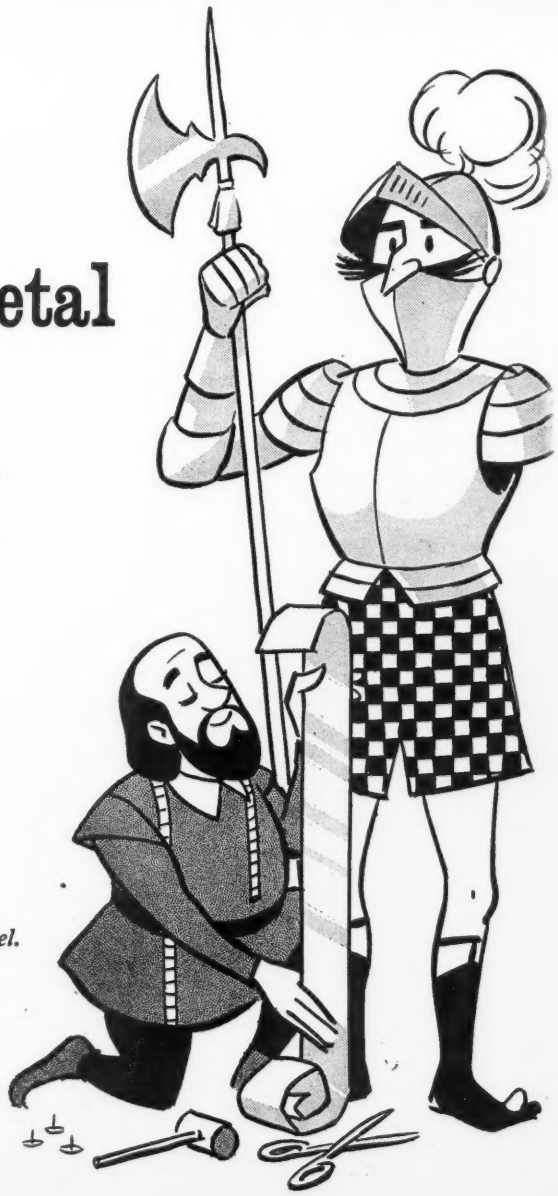

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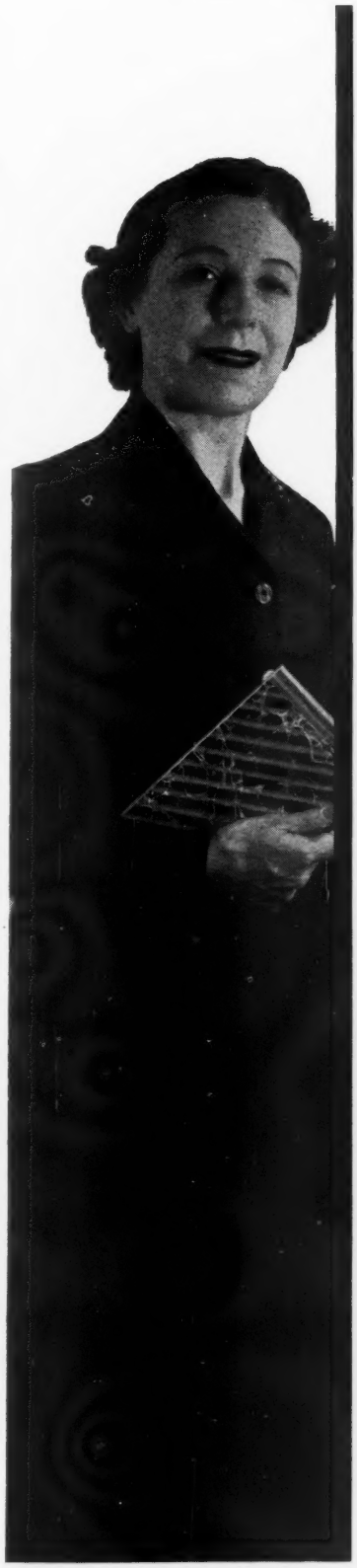

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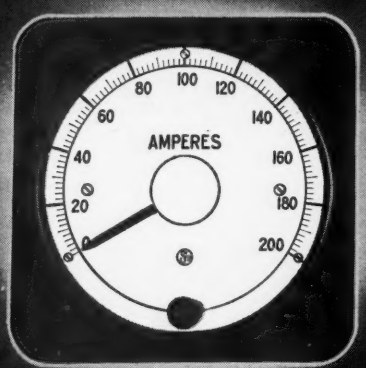

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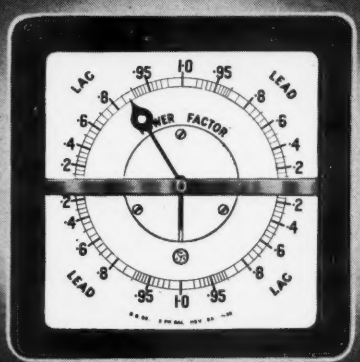

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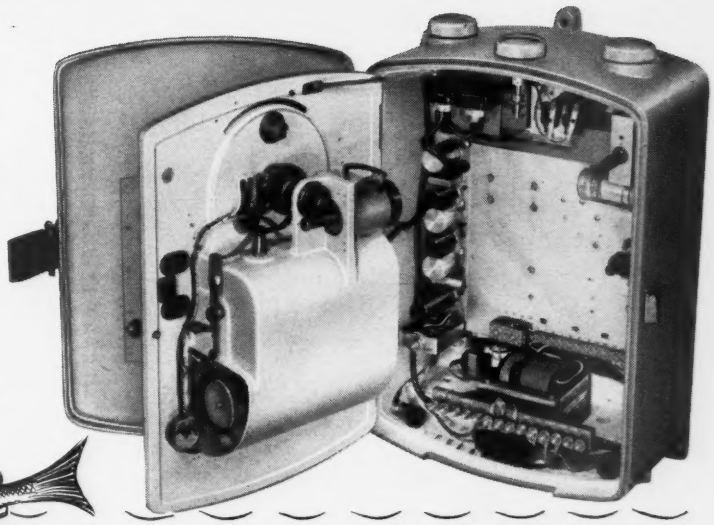
Kelvin Hughes new Fishmaster Echo Sounders reveal and record accurately the depth and size of fish shoals. These sensitive instruments call for bearings that turn at a touch and we are proud to be supplying large numbers of small instrument type ball bearings.

The three prizes for the heaviest herring haul have been won two years running by vessels fitted with Kelvin Hughes Echo Sounders.



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For many years now, since electricity was first used on a large scale, SLATE has been widely used for switchboard panels in many types of installation. Still uniquely suited to this purpose, SLATE is durable, non-conductive, rigid and will not warp. We supply panels to specified dimensions with a tough precision finish, and are also equipped to undertake drilling to particular requirements.

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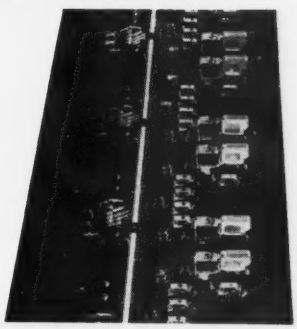

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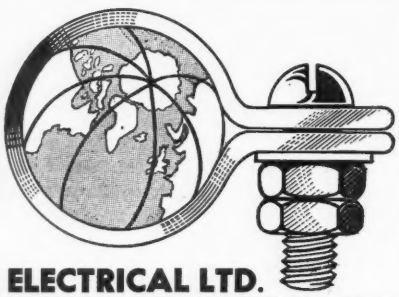

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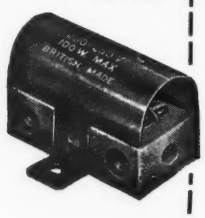

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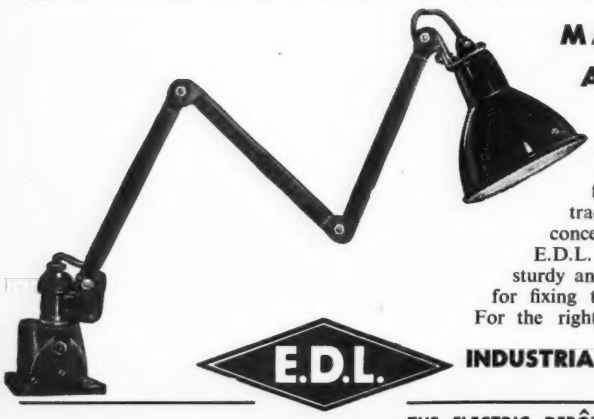

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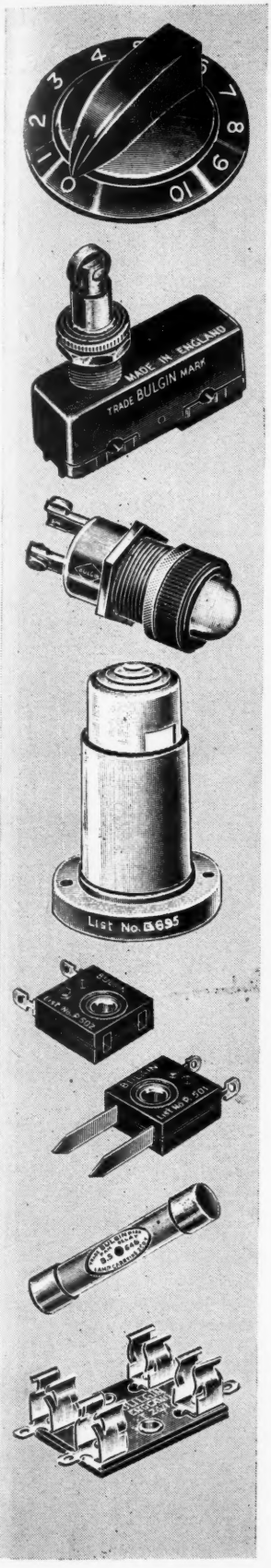

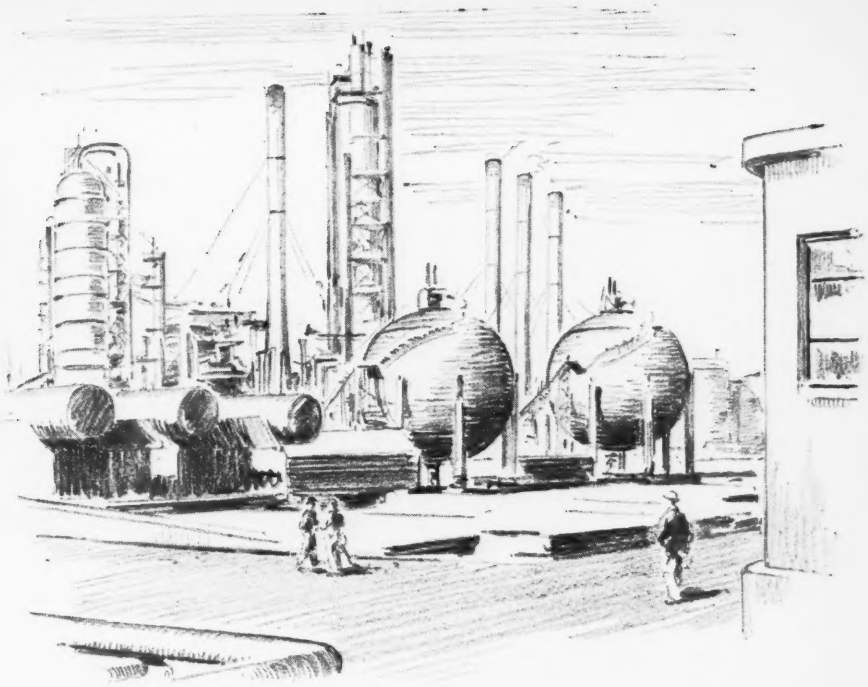

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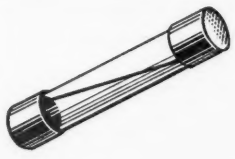

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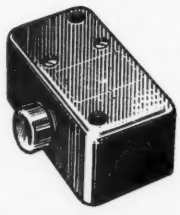

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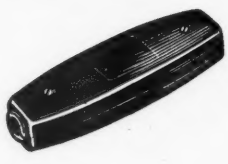

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If yours is a *very* special problem we shall be pleased to design and produce "made to measure" components.

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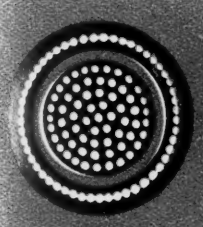

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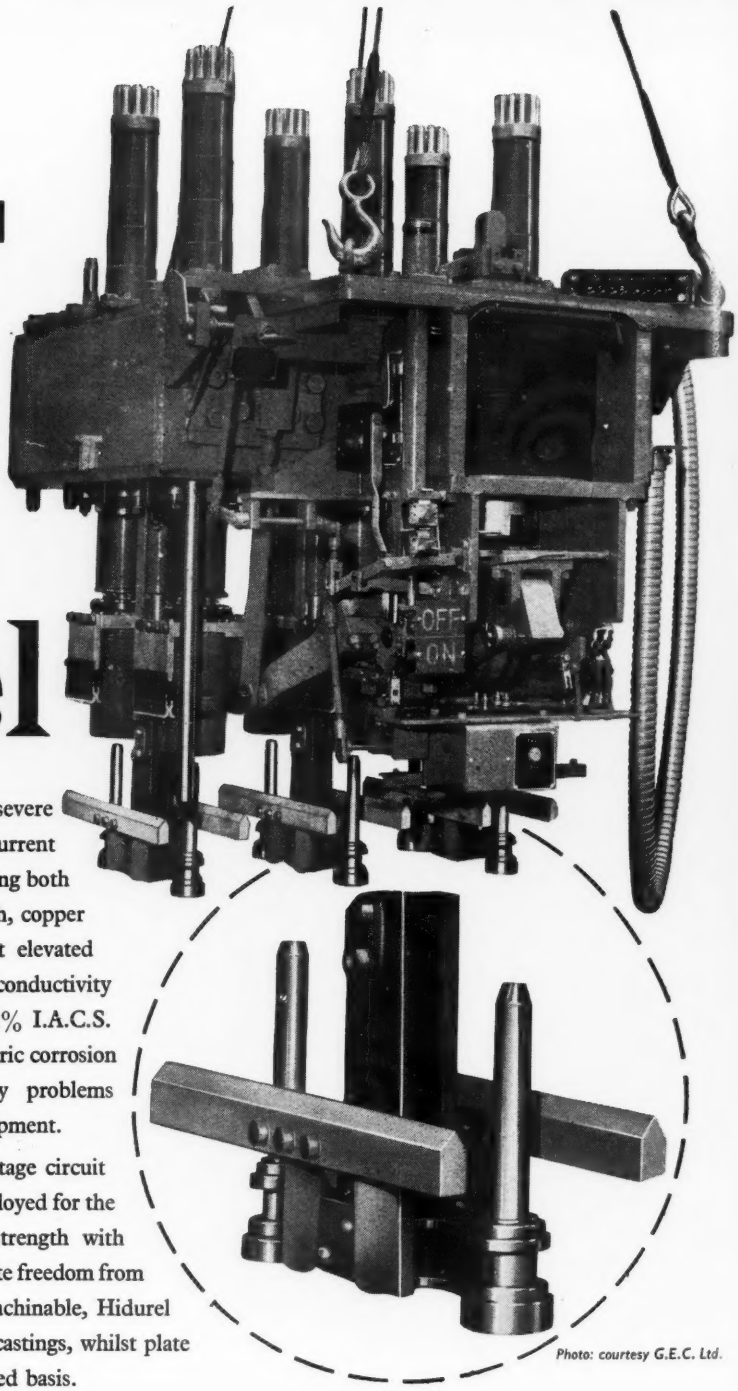

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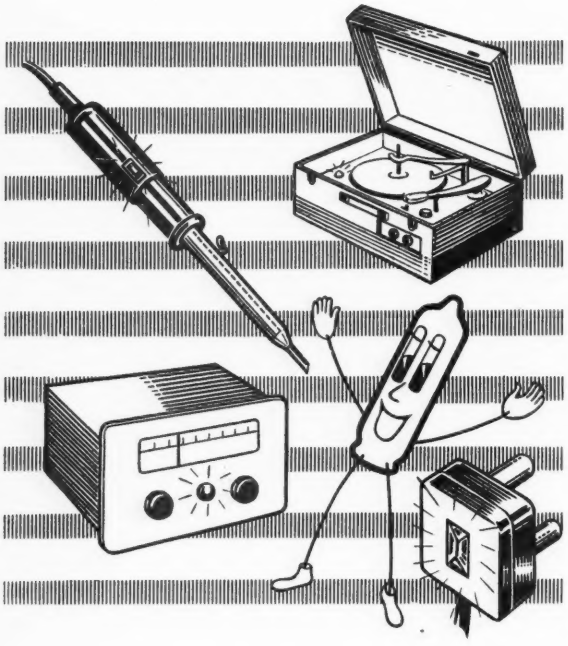

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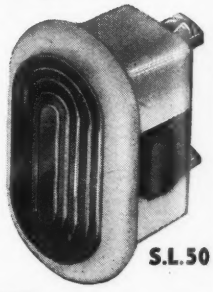

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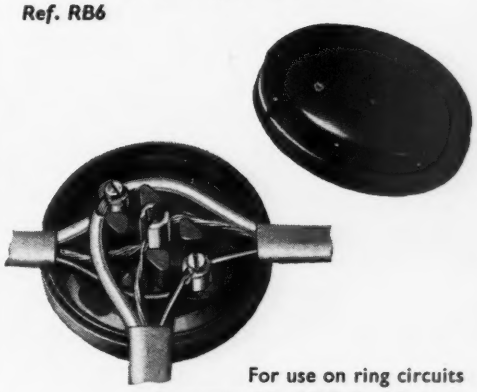

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For conductors up to 7/·036″

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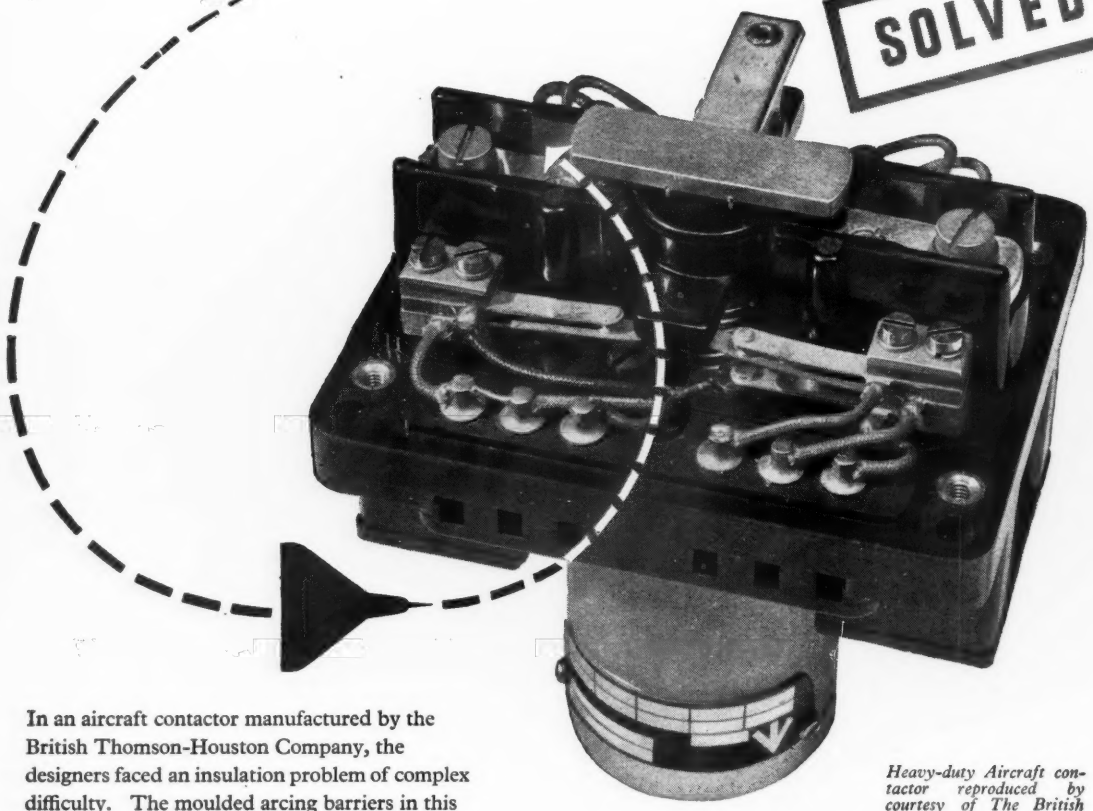

Heavy-duty Aircraft contactor reproduced by courtesy of The British Thomson-Houston Co. Ltd.

In an aircraft contactor manufactured by the British Thomson-Houston Company, the designers faced an insulation problem of complex difficulty. The moulded arcing barriers in this heavy-duty contactor are subjected to higher temperatures than can be withstood by normal moulding materials. The introduction of four inserts of "SILUMINITE" Melamine Resin Bonded Laminated Asbestos Paper Board, Symbol No. MELS. 2, which are moulded integral with the casing, has solved the problem. MELS. 2 is a high quality medium voltage insulation which will not burn and has very high resistance to tracking even under the worst conditions.

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of Asbestos Paper, Fabric or Felt

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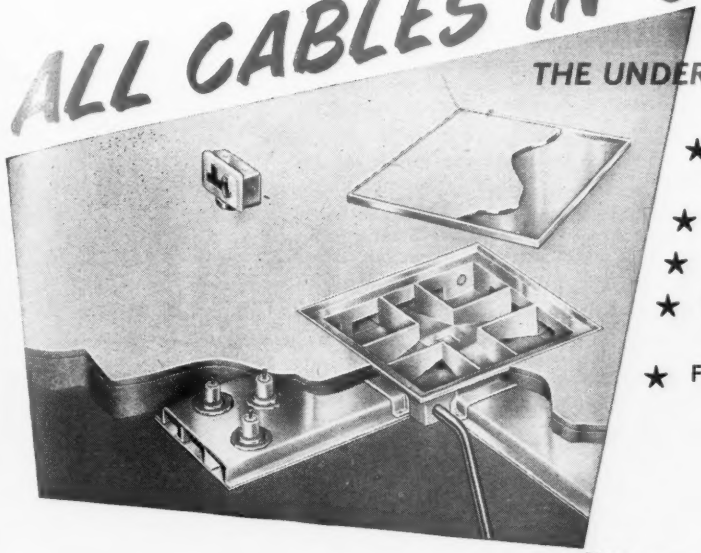

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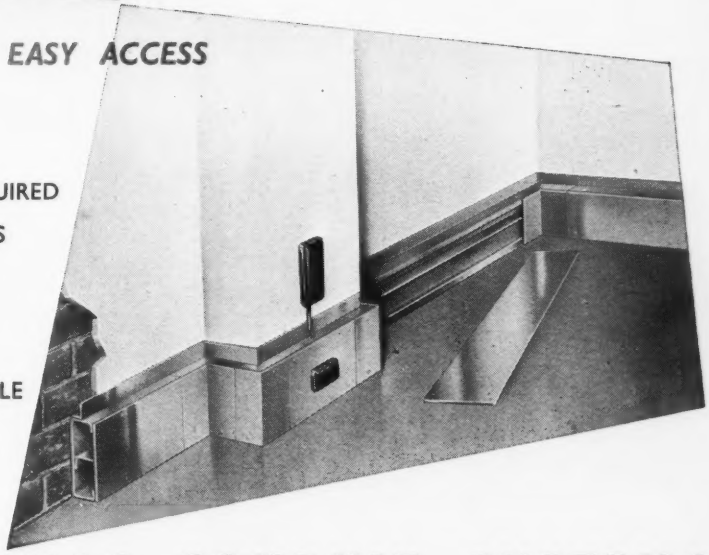

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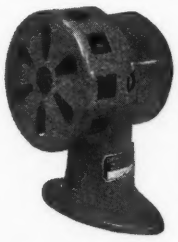
★ **This has been designed to "cut through" all noise levels in factories. These sirens can be supplied to work on any voltage AC or DC.**

★ **Easily portable (weight 4 lbs.) and can be carried round to every department and plugged into any convenient lighting point so as to determine the number required for the whole factory.**



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Our sirens, alarm pushes, and all our equipment are in accordance with the "British standards code of practice" and has the approval of Factory Inspectors.

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The lock barrel can accommodate panels up to ½" thick, and the key can be made to withdraw or not in a number of positions.

This method of control is of great value to plant engineers and manufacturers of equipment requiring operation by limited personnel.

Special Locks providing even greater secrecy can be supplied, as used by Atomic Energy Establishments.

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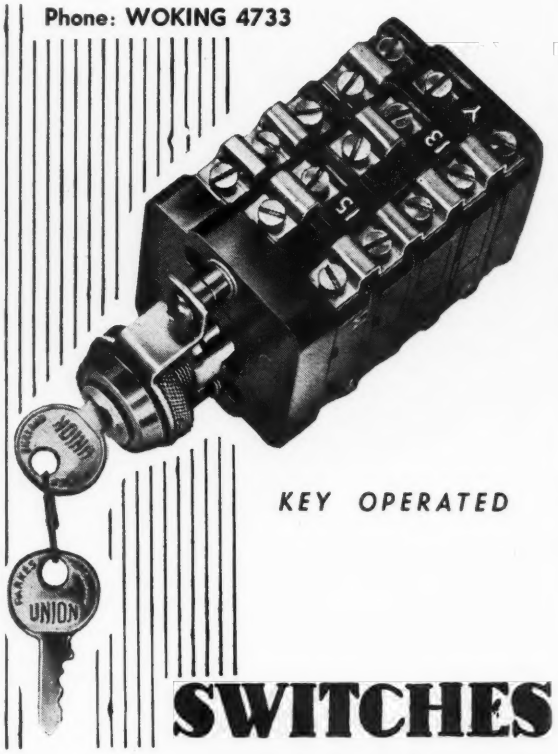

KEY OPERATED

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modestly speaking . . .

Our friends tell us that we're far too modest. It is not enough to make some of the finest electrical components in the world. We must *tell* the world that we make them. So here we go. Our name is E. N. BRAY LTD. and for over 30 years we have been kind of "back room boys" to the electrical industry. We make relays, contactors, starters, rheostats and similar equipment. We are particularly well suited to handle rather out-of-the-ordinary jobs, and having just moved into a brand new factory we now want some brand new business to go with it. Why not send us an enquiry right away. Start off modestly by all means—the big orders are sure to follow in due course.

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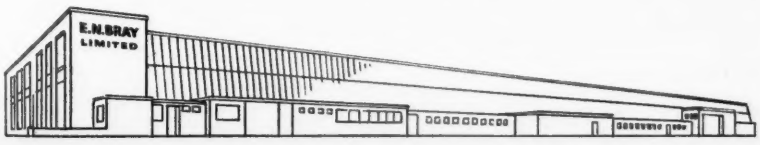

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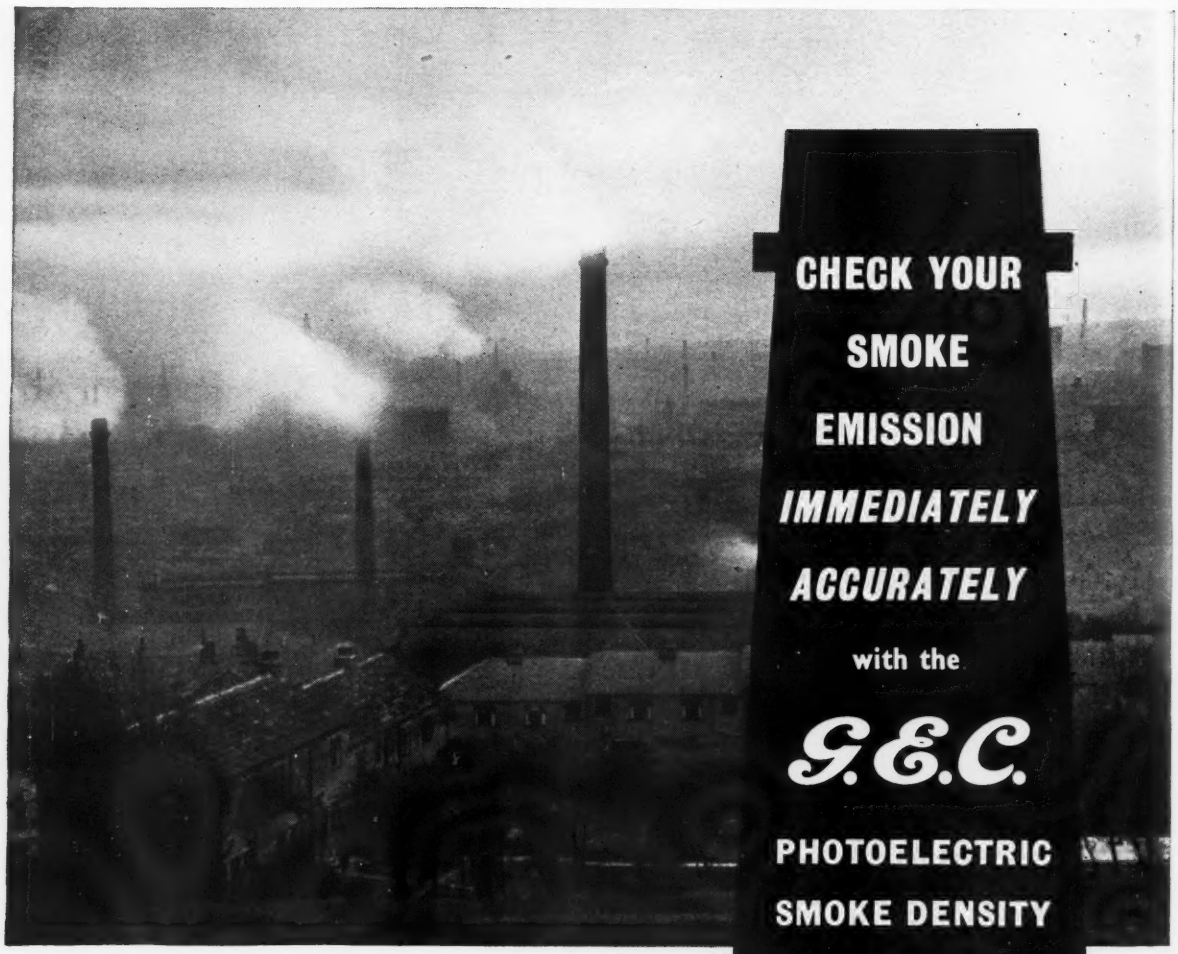

CHECK YOUR SMOKE EMISSION *IMMEDIATELY ACCURATELY*

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The G.E.C. Photoelectric Smoke Density Monitor has been designed, in the interest of smoke abatement, to monitor the density of smoke in a stack. A light beam is projected across the stack. Visual and audible alarm systems operate whenever the density exceeds a pre-set level, the event being recorded. The circuit is designed so that, wherever possible, failures of components set the warning relay to the alarm position.

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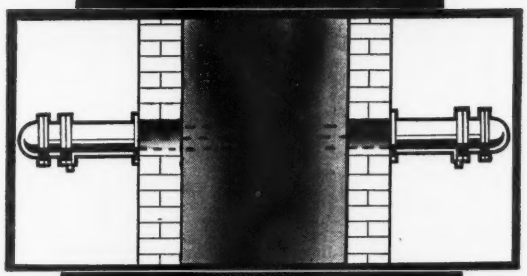

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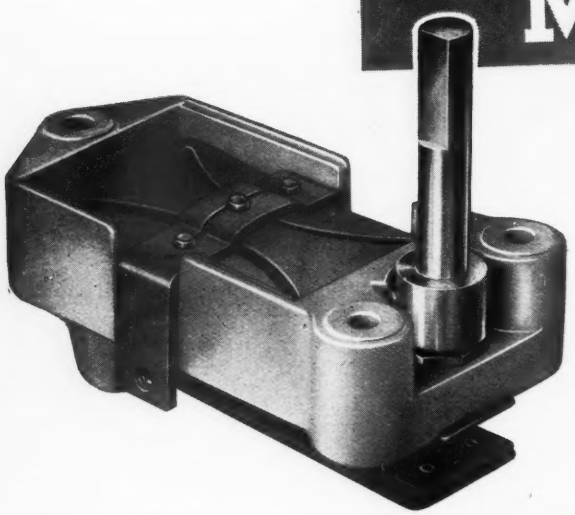

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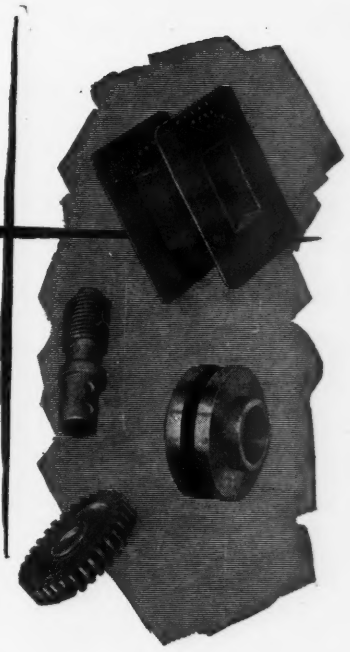

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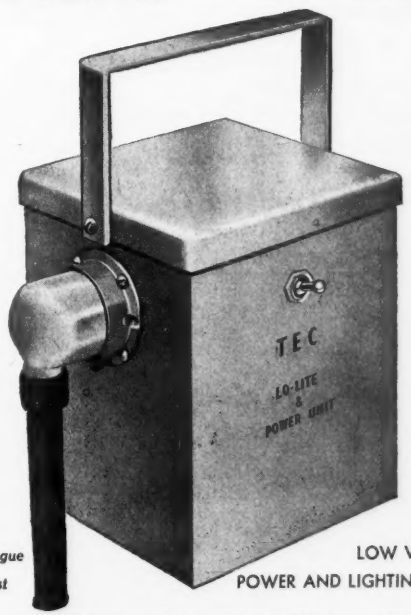

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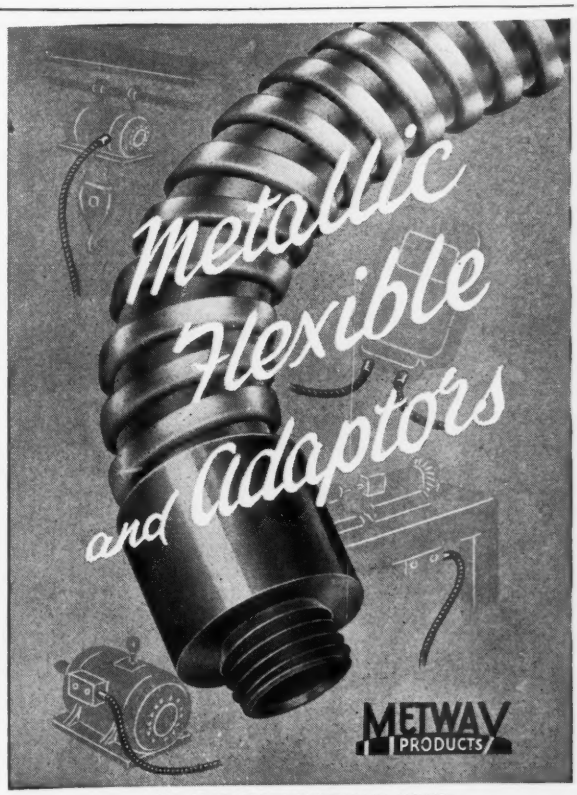

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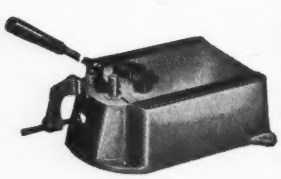

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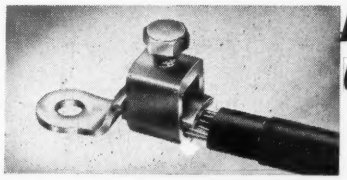

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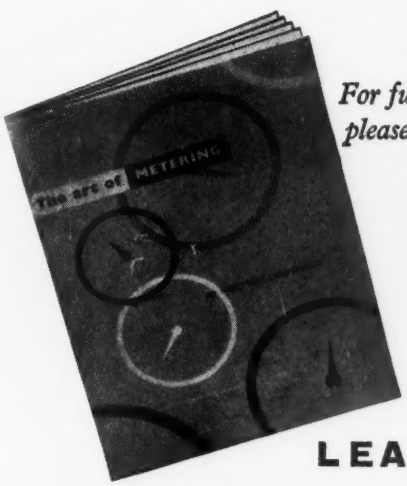

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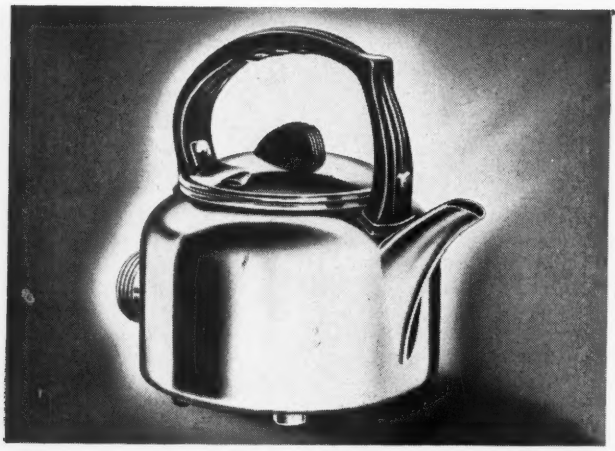

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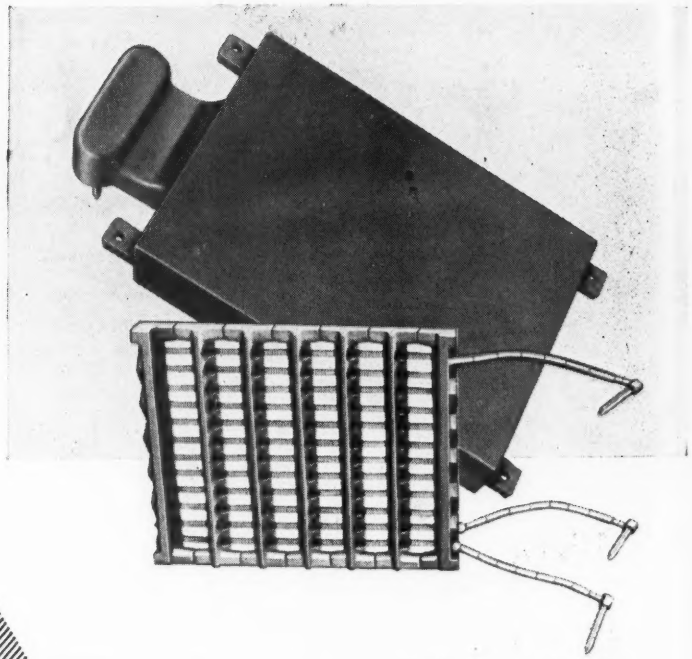

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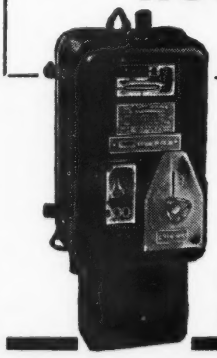

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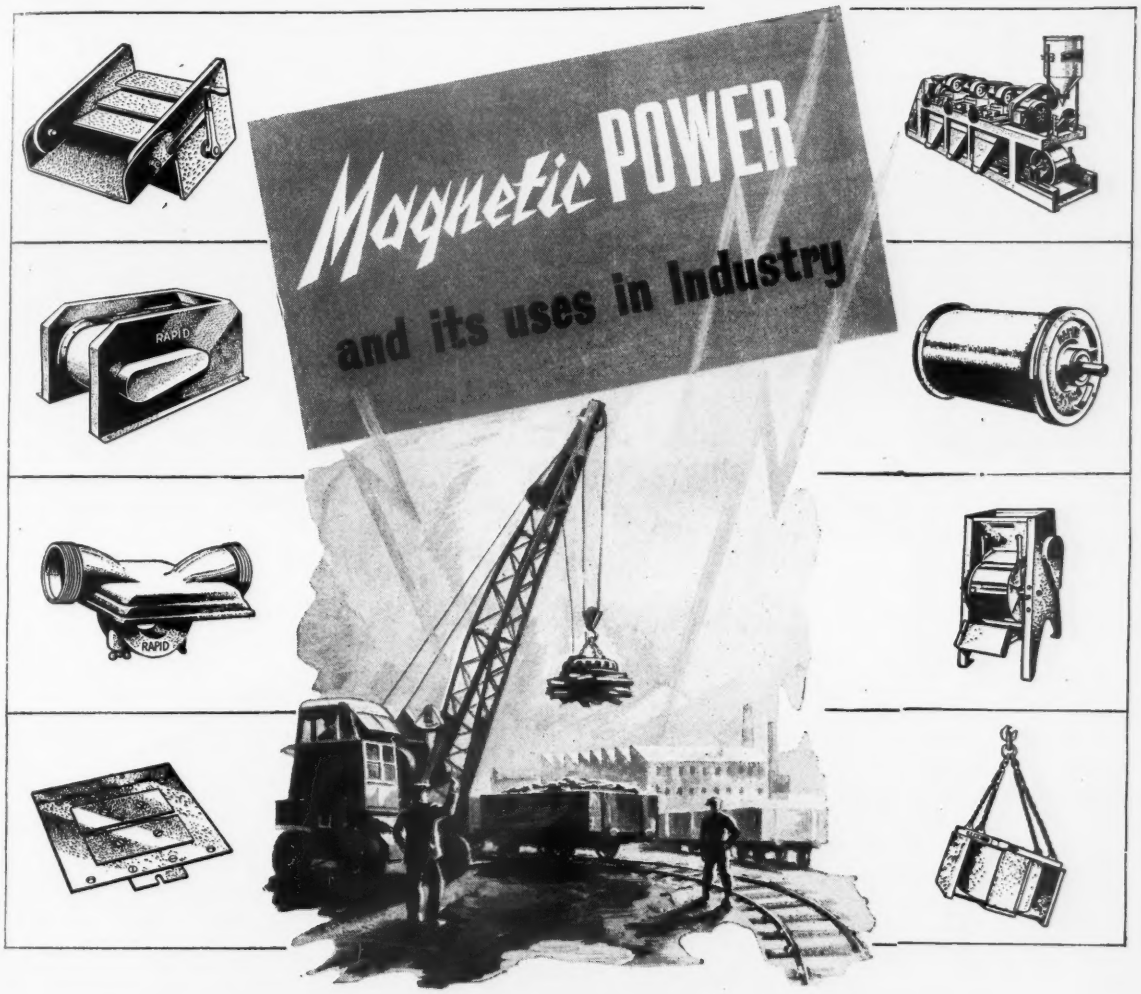

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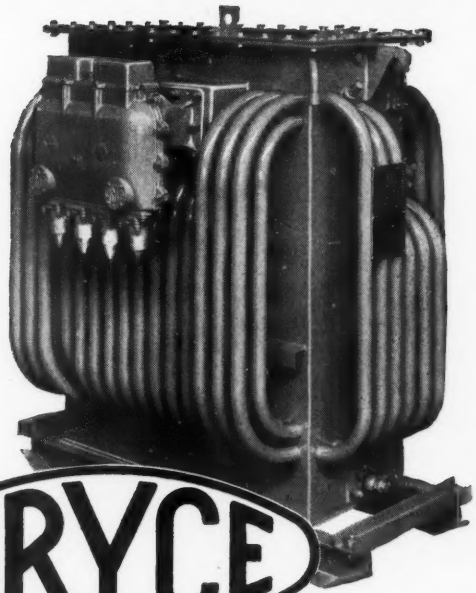

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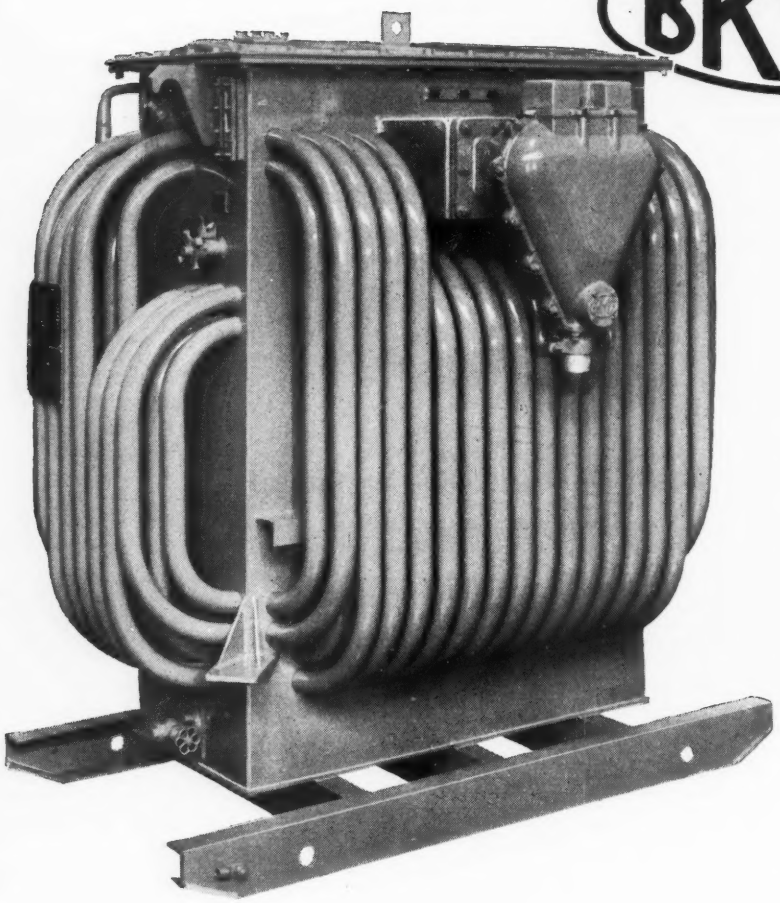

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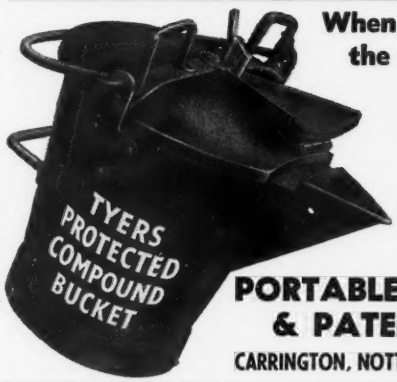

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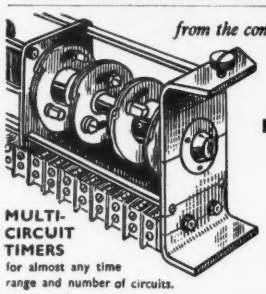

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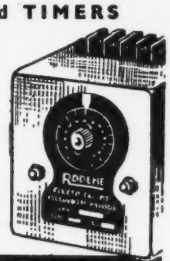

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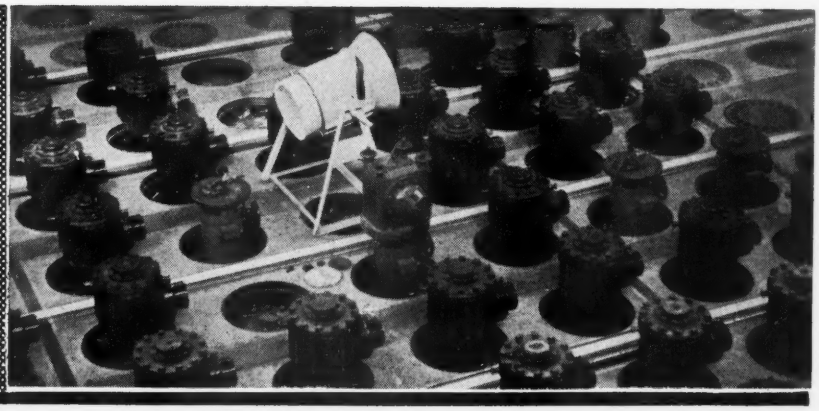

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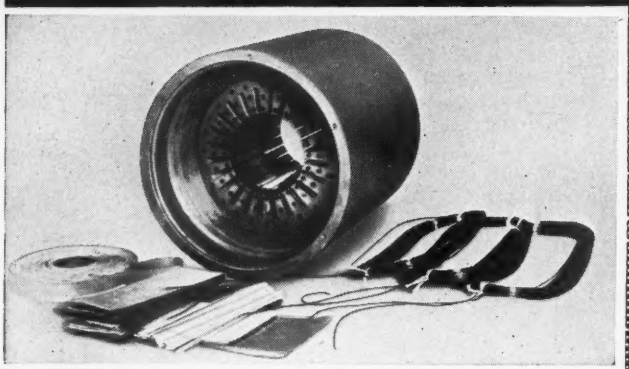
–AND SAFER. Silicone insulated dry-type transformers offer a safer alternative to oil-filled units.



One of the motors is shown before winding. The following silicone insulation components are employed:

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SLOT LINERS – *Silicone-bonded mica backed with glasscloth.*
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Photograph by courtesy of Metropolitan-Vickers Electrical Co. Ltd.

OUR ELECTRICAL ENGINEERS CAN HELP YOU

Our electrical engineers and Technical Service Department are ready to help you in the choice of silicone insulation and its application.

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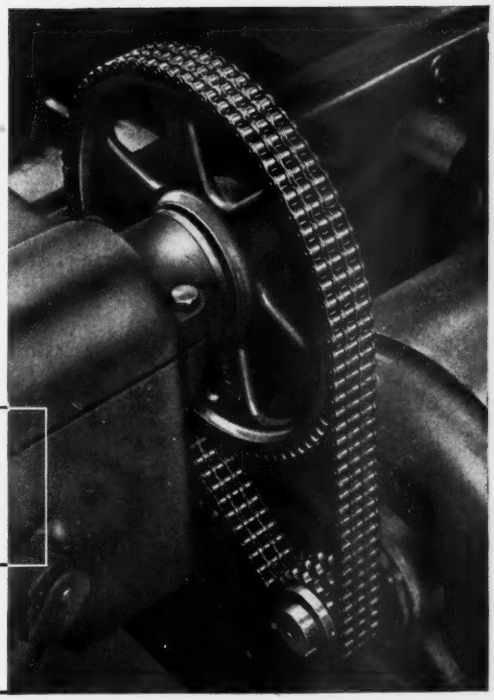

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Only 17 in. centres could be allowed for this drive from motor to heavy lathe — and only a Renold stock chain drive could transmit the necessary power at such short centres.

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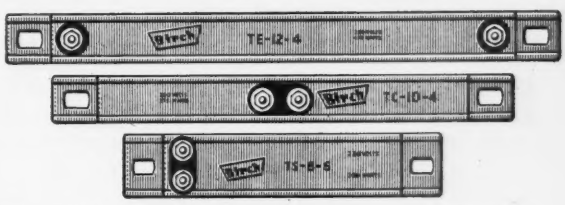

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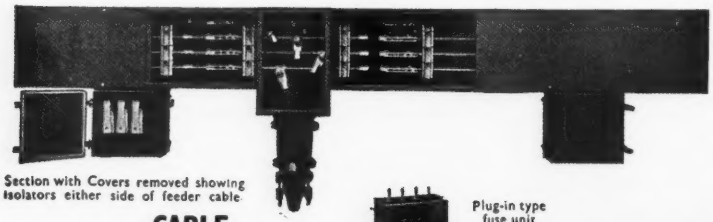

Section with Covers removed showing isolators either side of feeder cable

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100 to 2000-amps capacity. A design for all requirements with fixed or plug-in type fuse units. Also for rising mains

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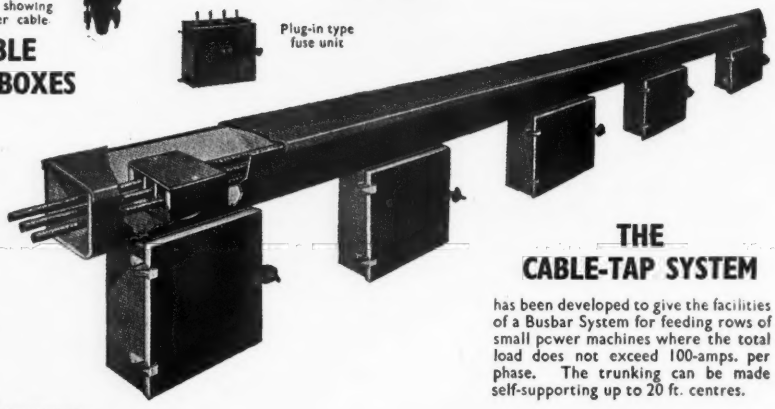

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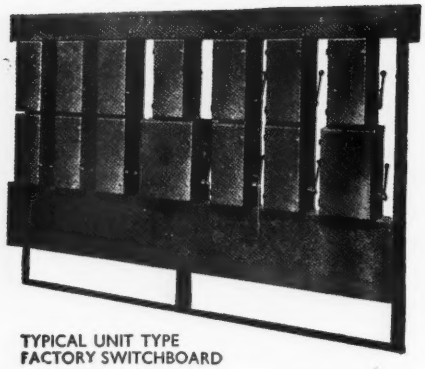
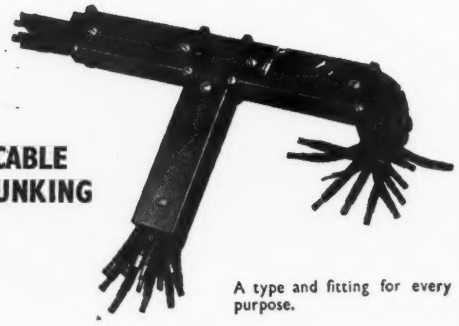


TYPICAL UNIT TYPE FACTORY SWITCHBOARD

CABLE TRUNKING



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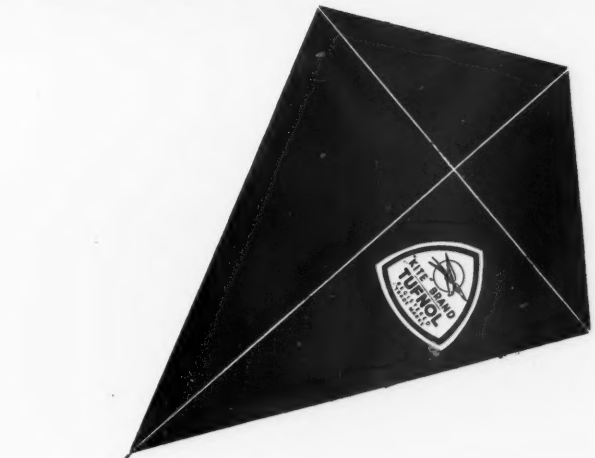
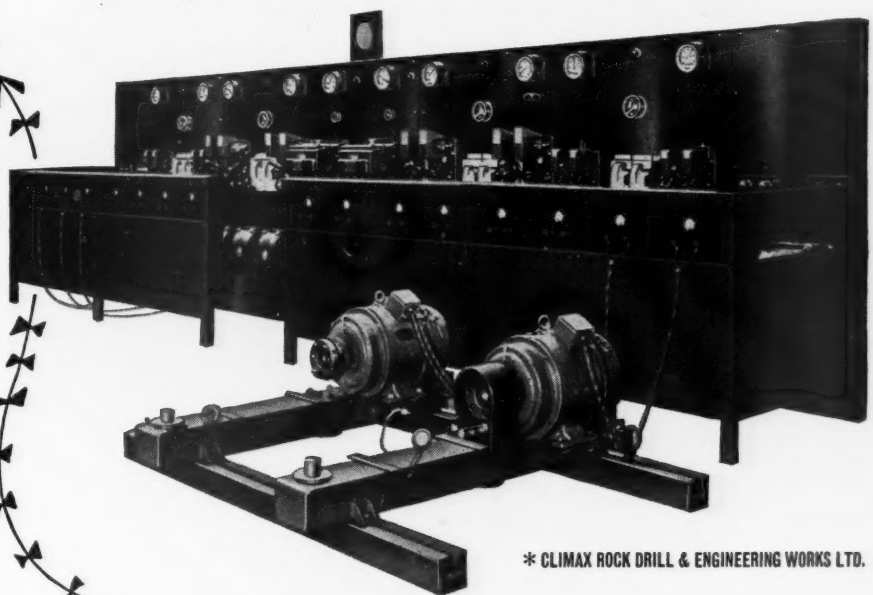


Black Kite at Redruth

*Climax of Redruth, Cornwall, chose black Tufnol panels made from Kite Brand for their heavy duty switchboards.

Tufnol Kite Brand sheet combines high grade electrical insulation with mechanical strength. It has a tensile strength of 20,000 lb. per square inch and to chip it is almost impossible.

Tufnol can be drilled, tapped, routed, sawn or turned with all the normal engineering tools. Write for further information on this modern material.



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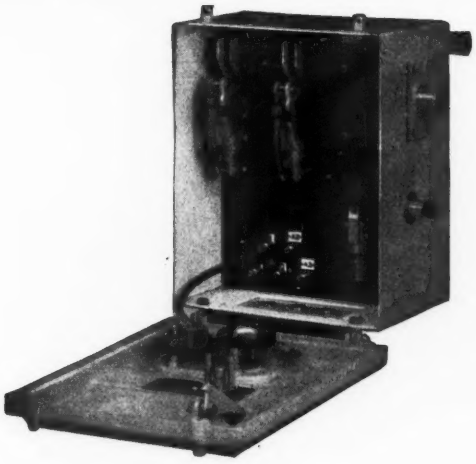

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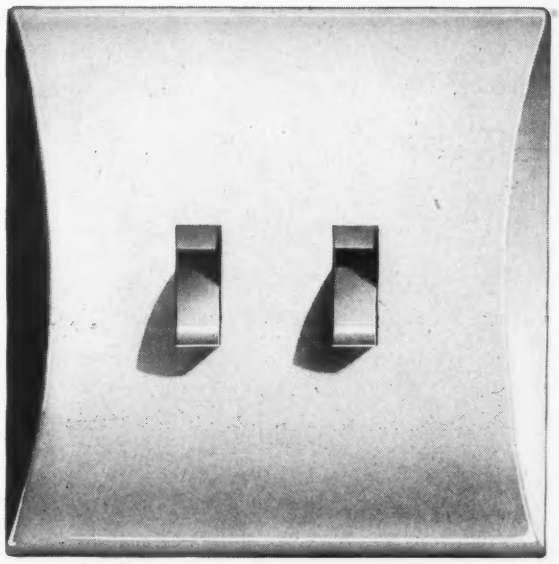
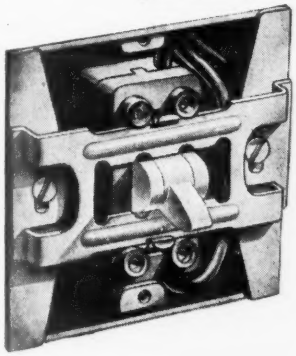


FALKS new switch makes others obsolete

Here is a handsome new switch, modern in every respect and unique being without plate fixing screws.

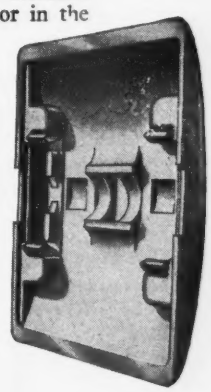
The design must appeal to every architect and its simplicity to the contractor in the saving of fixing time.

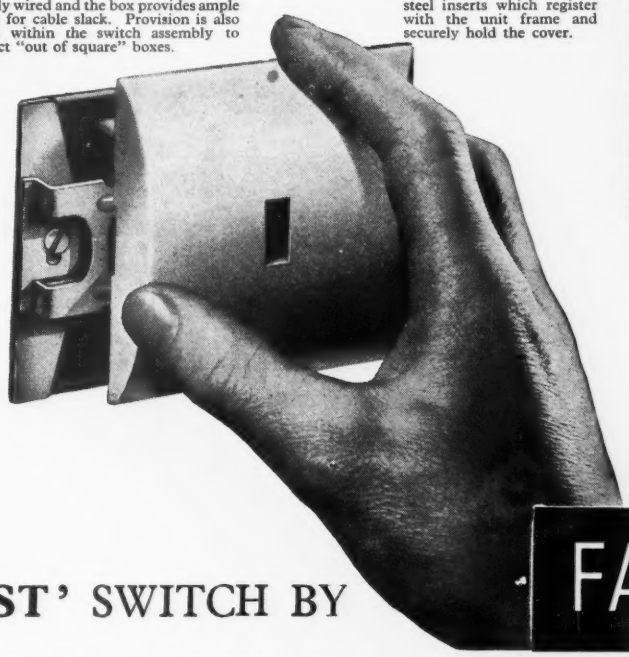
Note these special features—



The 'Snapfast' switch unit is fitted to the standard box by two screws. It is very readily wired and the box provides ample space for cable slack. Provision is also made within the switch assembly to correct "out of square" boxes.

The secret of the FALKS 'Snapfast' lies in the Spring steel inserts which register with the unit frame and securely hold the cover.





It is now the simplest of operations to snap the cover into position. Although firmly fixed it can be prised off and replaced without damage to switch or surroundings.

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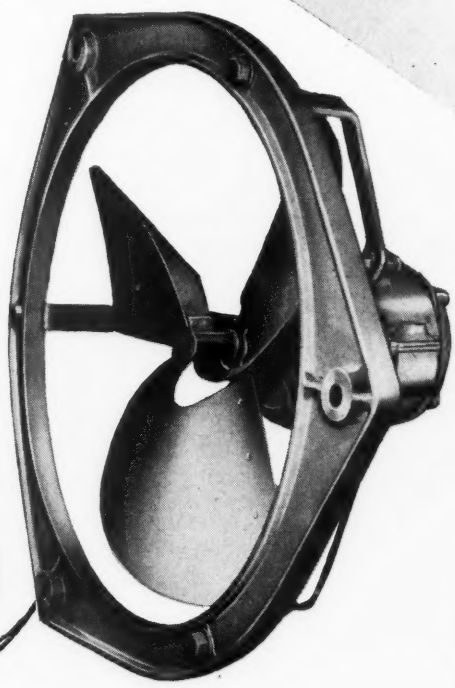

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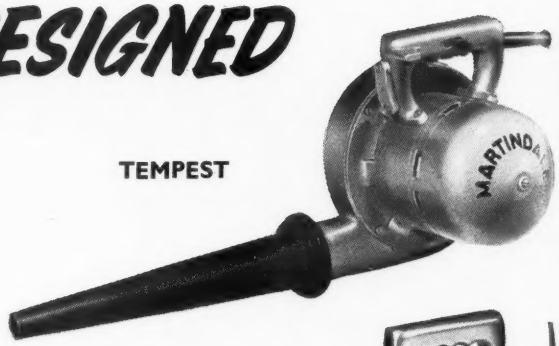

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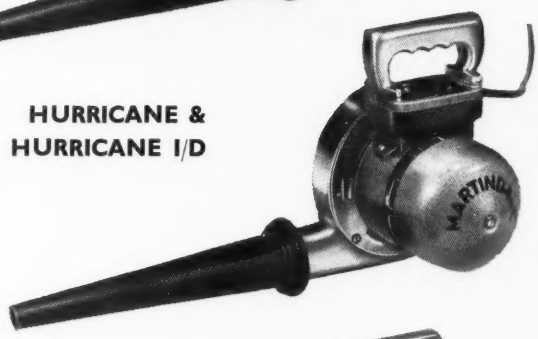

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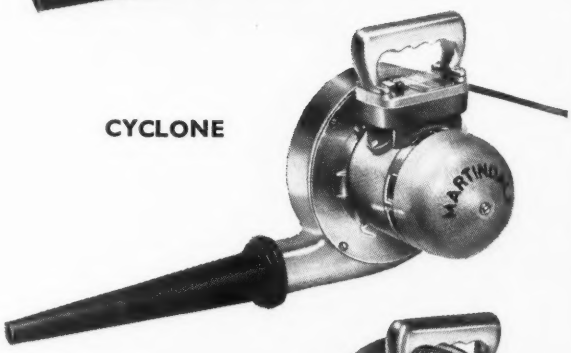

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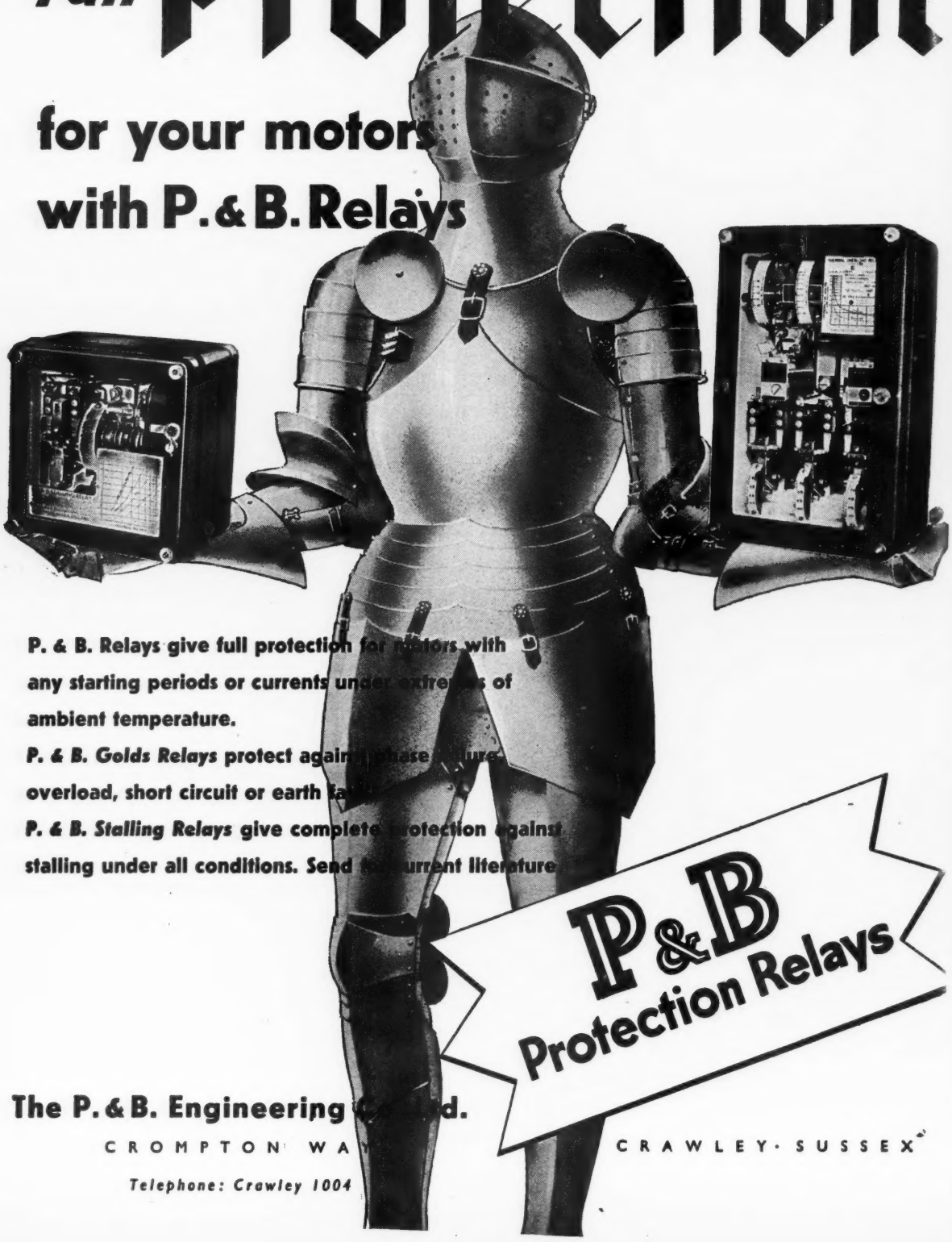

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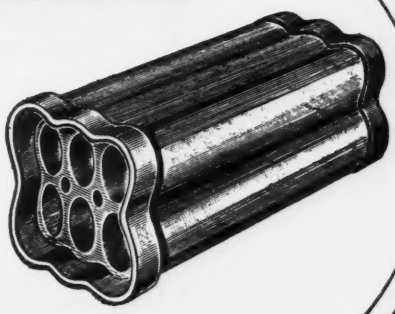

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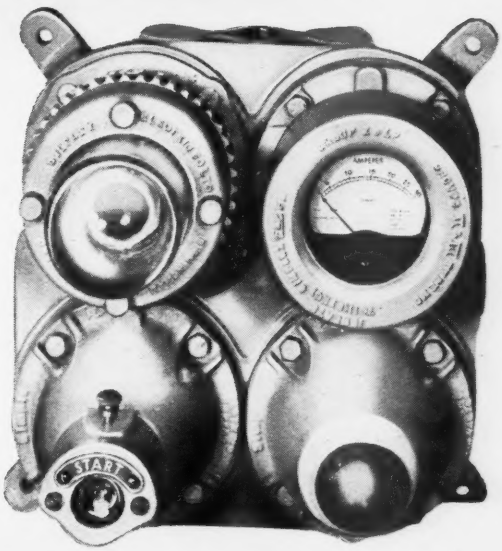

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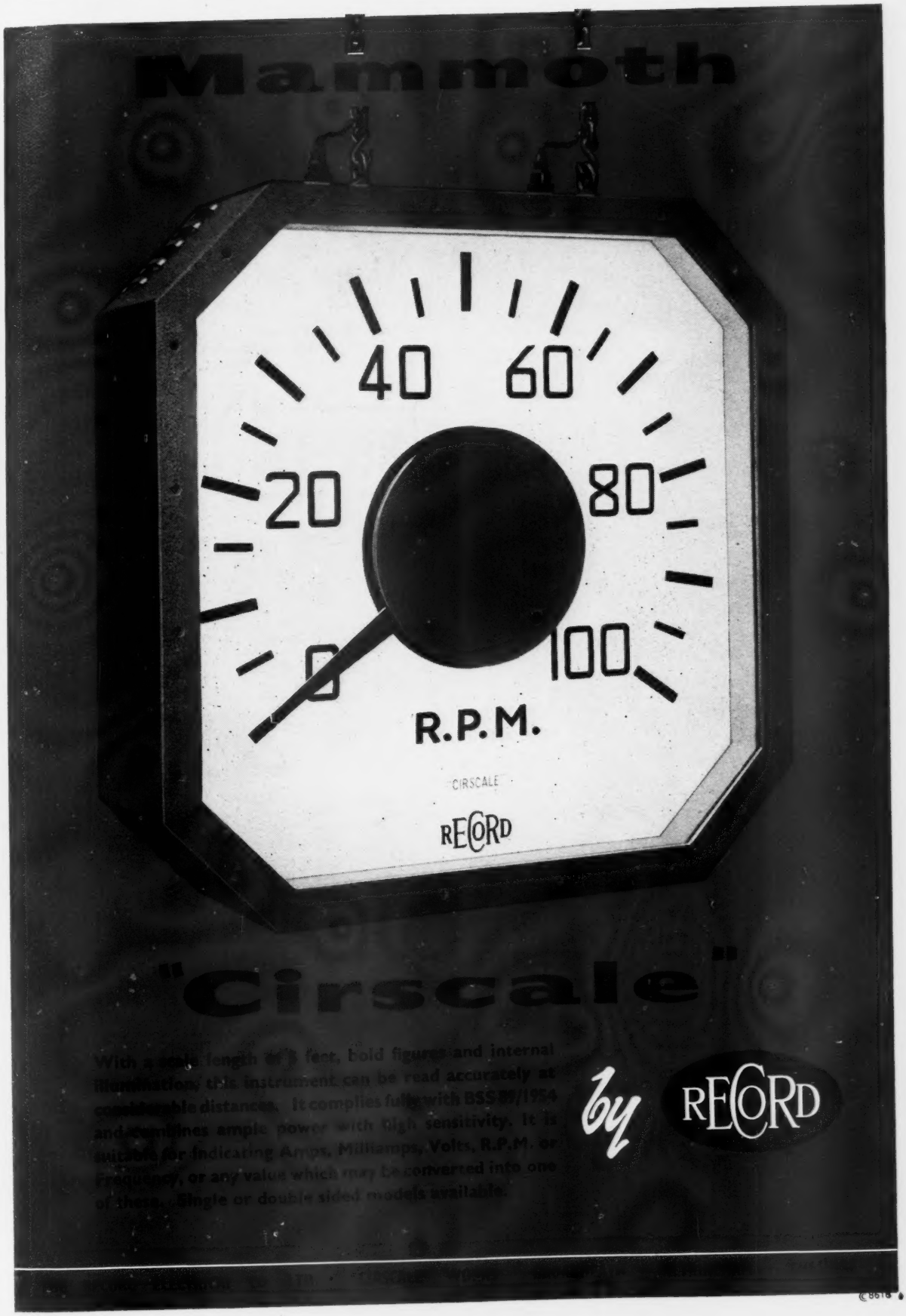
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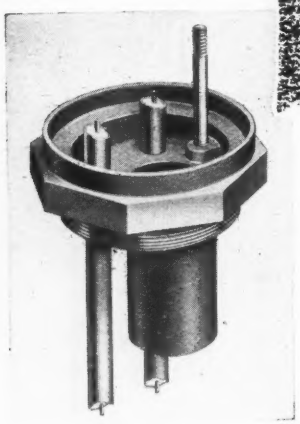

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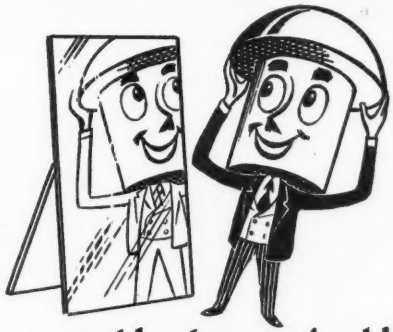

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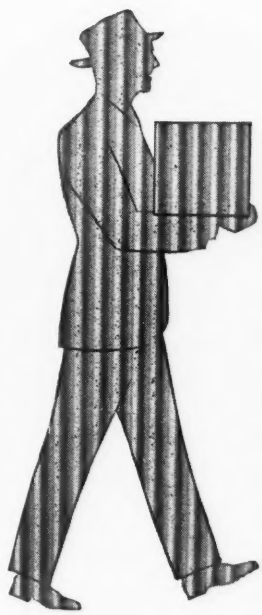

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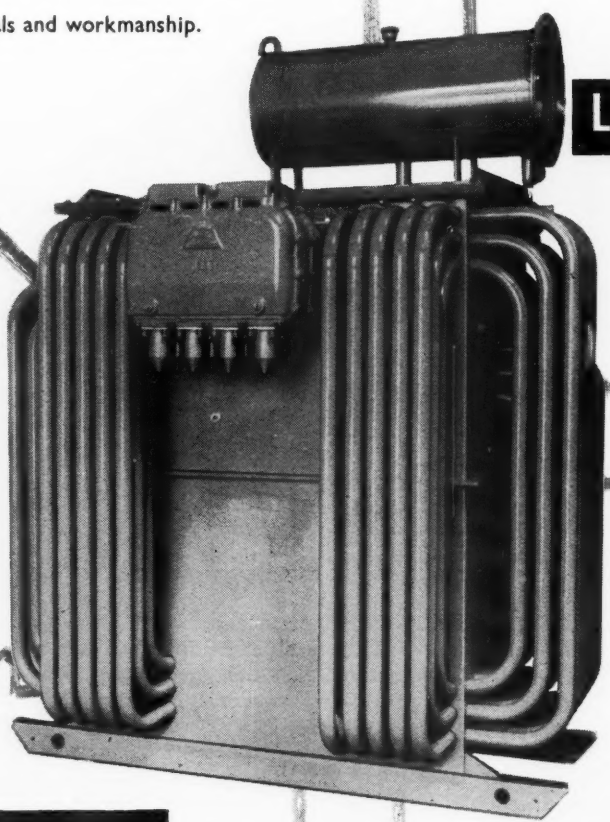

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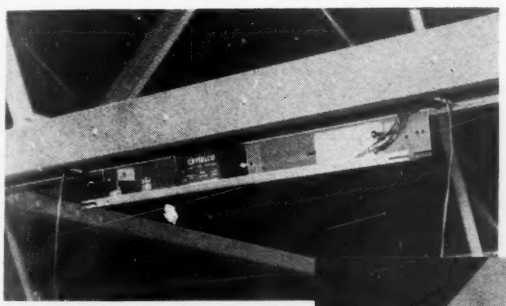
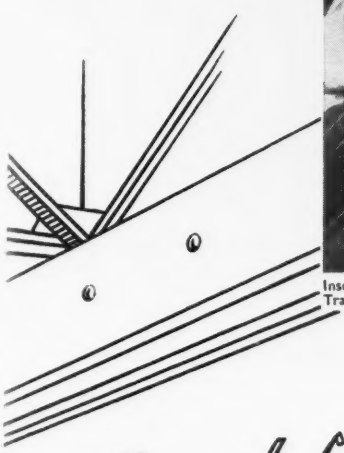
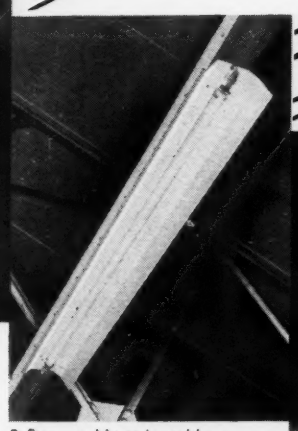


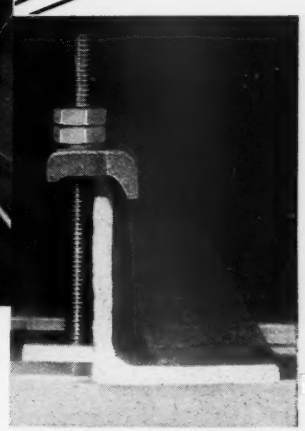
Gear Tray suspended for maintenance purpose



Inserting Locking Screw for Tray and Reflector



Reflector and Lamp in position



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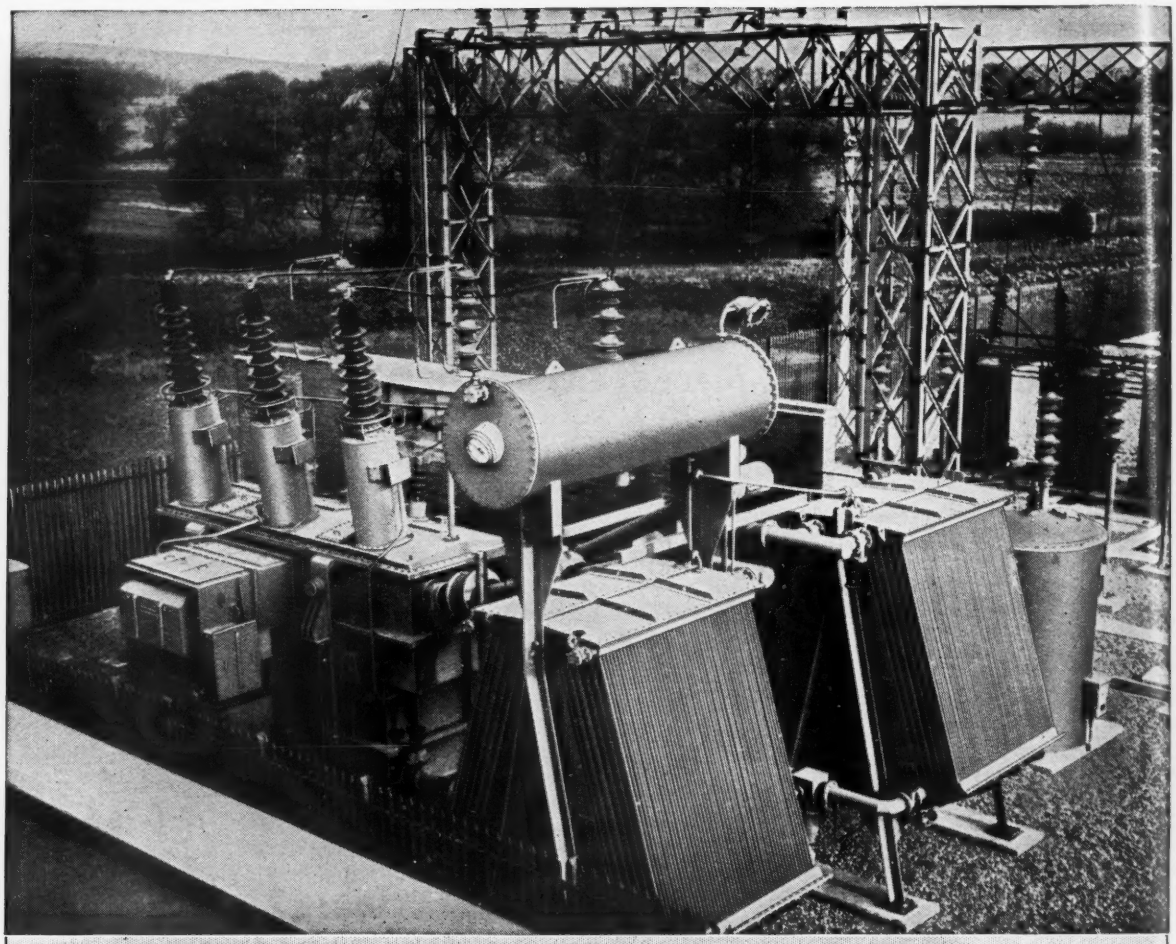

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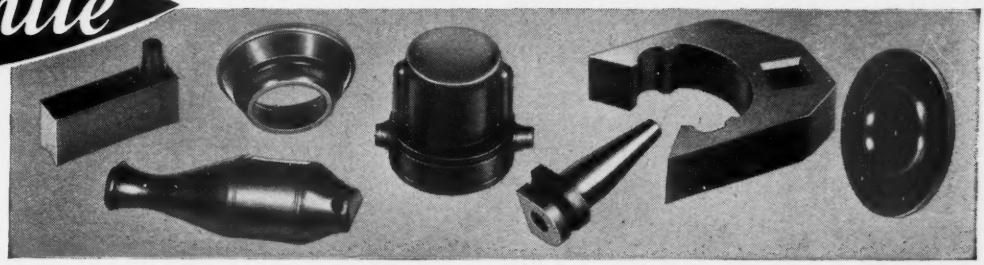

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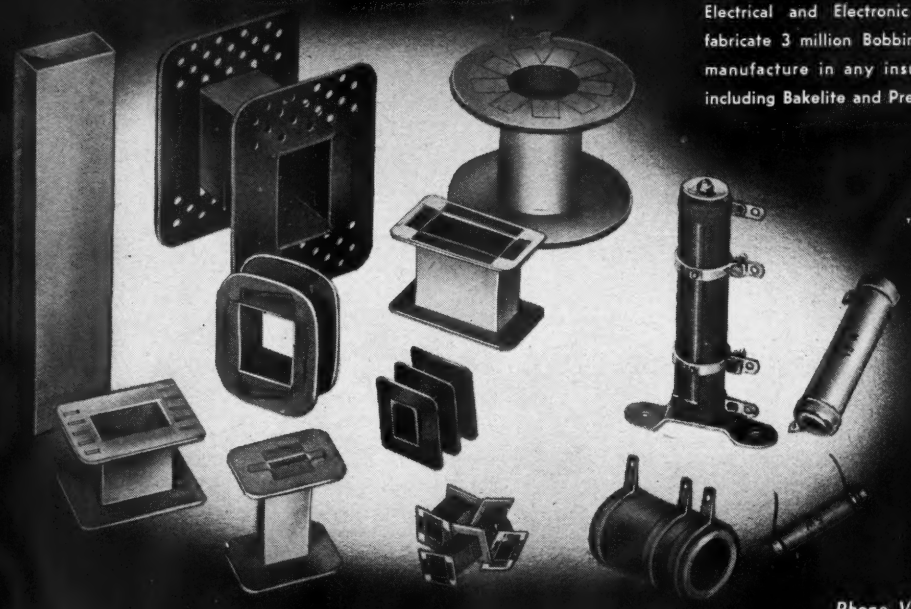

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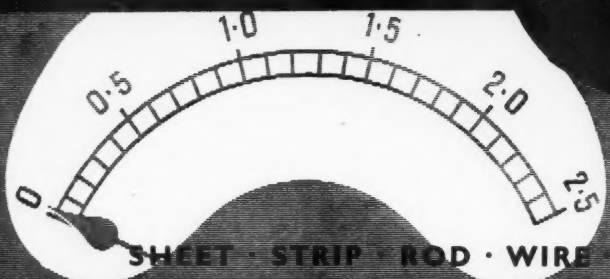

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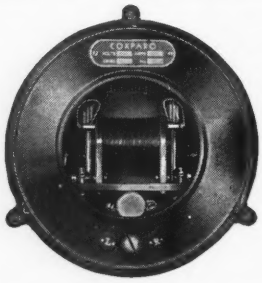

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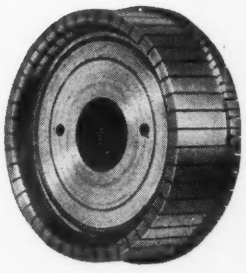

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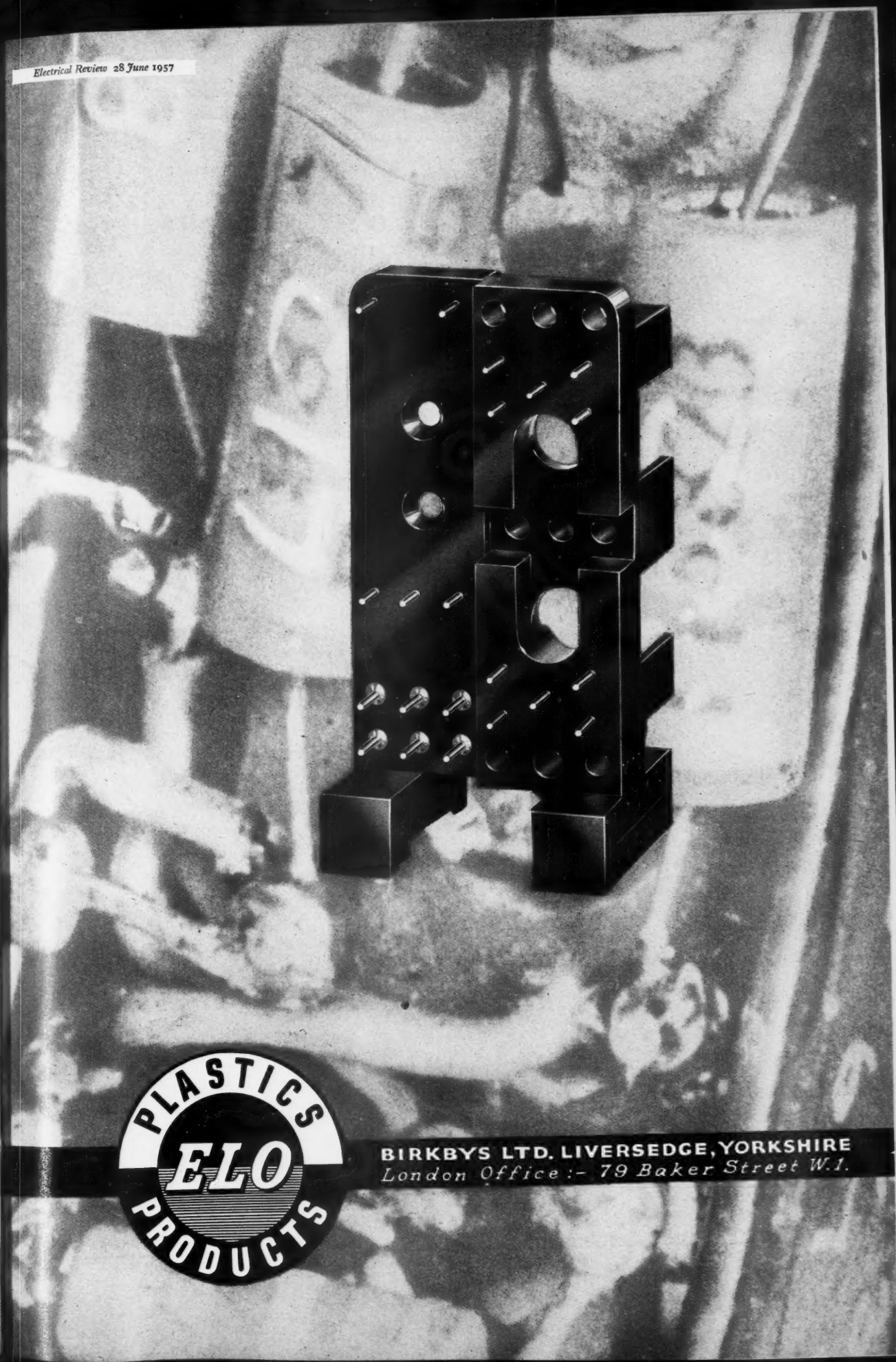
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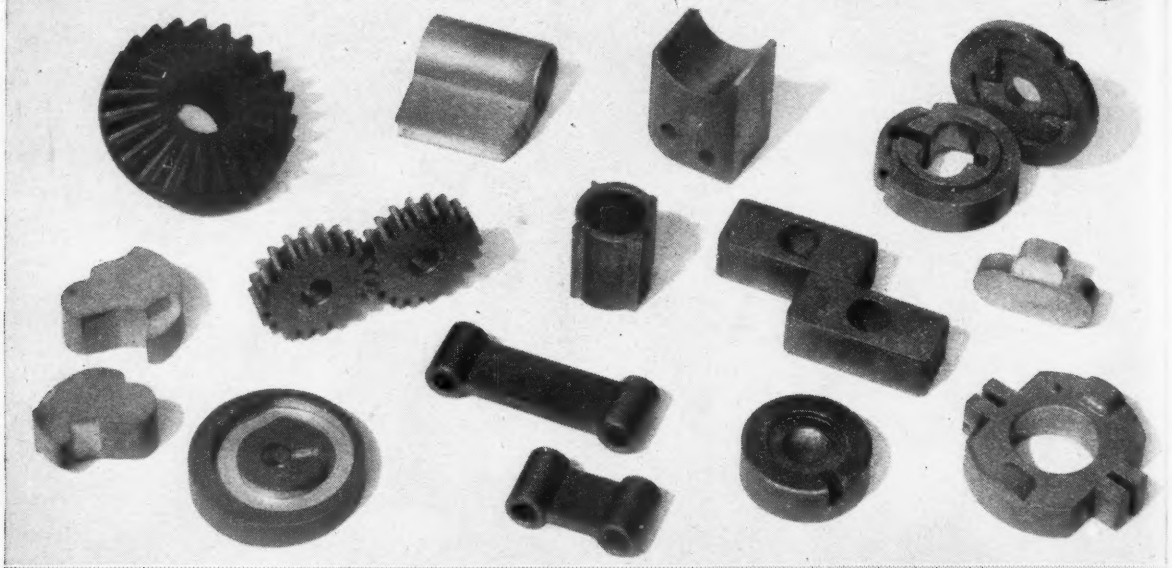

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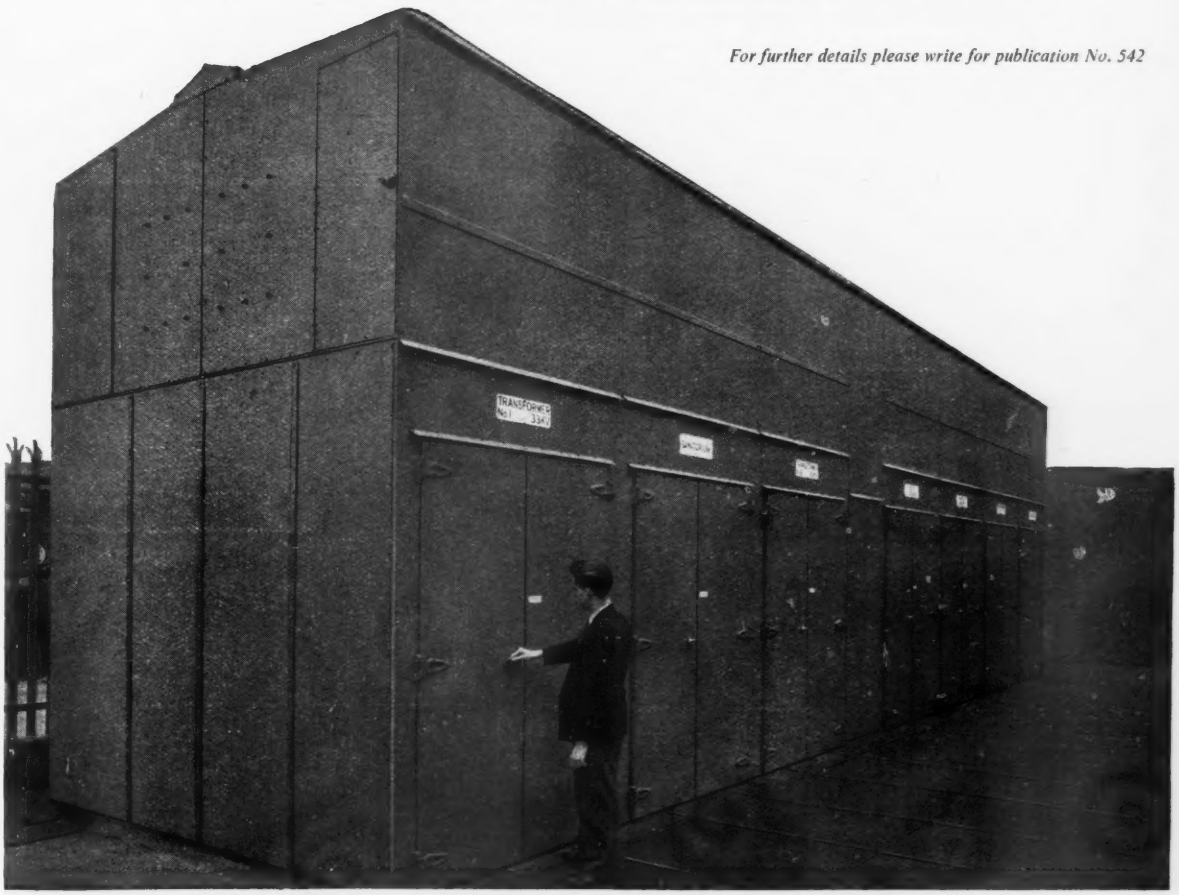

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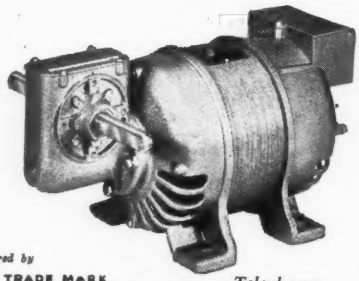

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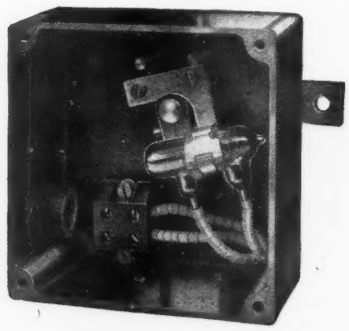

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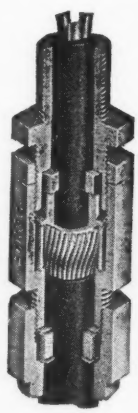

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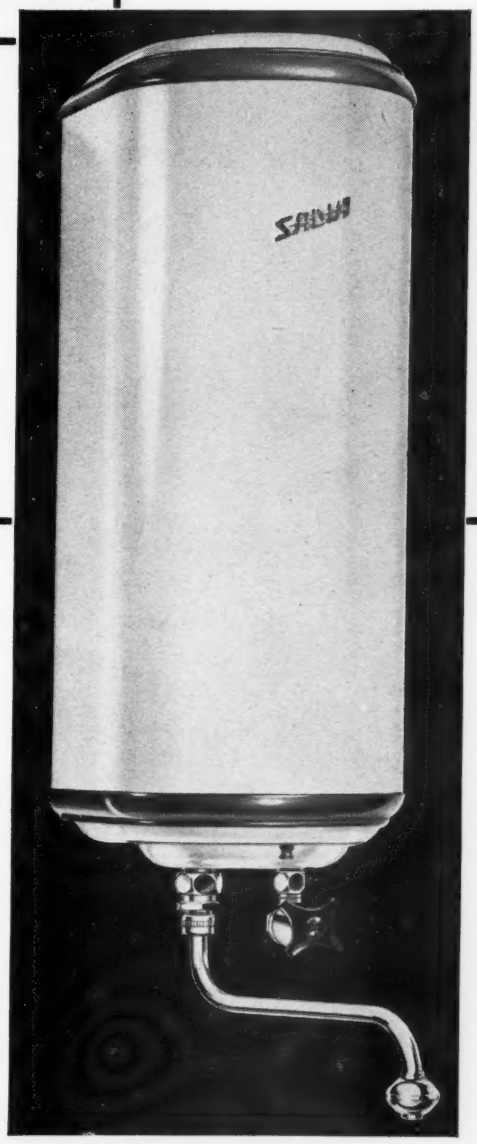

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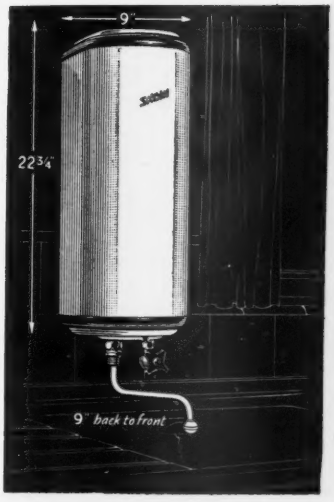

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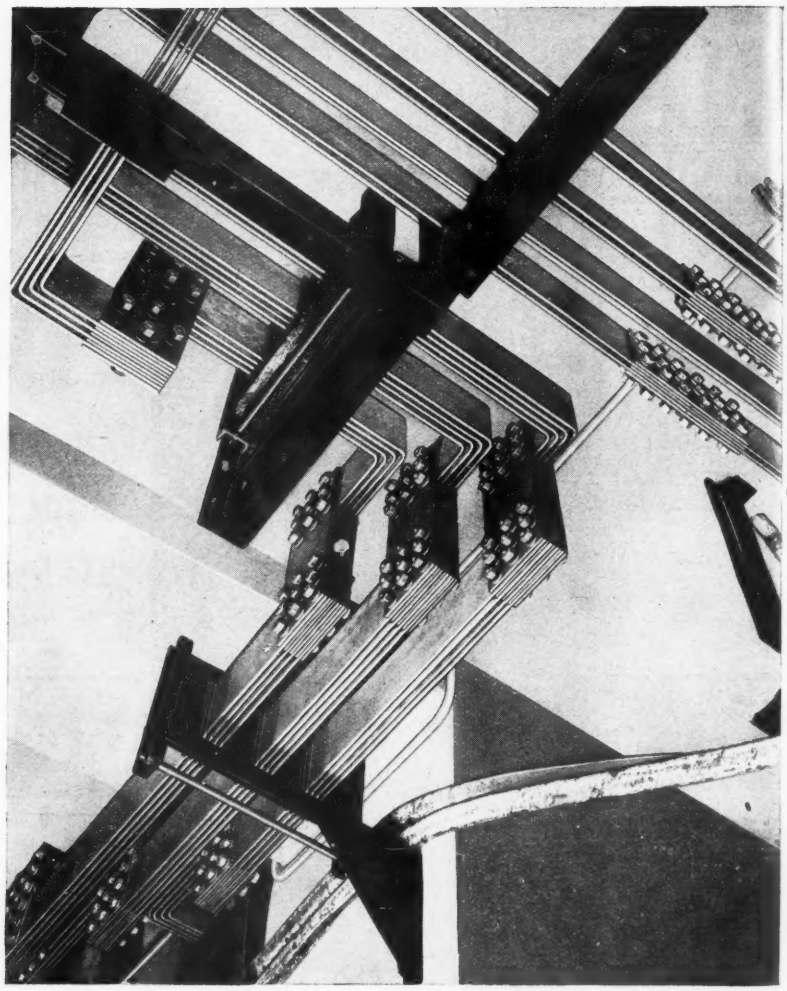
Something new in busbar materials



Here is something entirely new in busbar materials — an aluminium alloy that combines strength with lightness and high current-carrying capacity.

Noral D50S, newly developed specifically for busbars, has these properties:

Minimum ultimate tensile strength—13 tons/sq. in.
Minimum 0.1% tensile proof stress—10.5 tons/sq. in.
Electrical resistivity—3.133 microhms/cm. at 20°C.
Temperature coefficient of resistance—0.00364/°C.

In terms of the efficiency of a busbar installation, these figures add up to the significant fact that a light, low-cost Noral D50S installation can be the *mechanical* equivalent of its counterpart in copper. Moreover, the resistance temperature coefficient of this alloy, being lower than that of electrical purity aluminium, largely offsets its slightly lower conductivity at working temperatures.

When it comes to economics, an aluminium busbar is a sound proposition indeed. Add to this initial advantage the properties now offered by Noral D50S alloy, and you have a material that will inevitably become first choice for all types of installation.

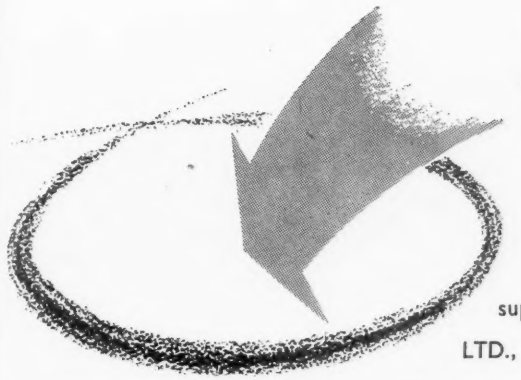
May we send you further details? Just write or phone to the nearest of the sales offices listed below.

Northern Aluminium

Northern Aluminium Company Limited, Bush House, Aldwych, London, W.C.2. *An* **ALUMINIUM LIMITED** *Company*

Area Sales Offices

BIRMINGHAM: 14 Bennetts Hill, Birmingham 2. *Telephone: Midland 5236.* **BRISTOL:** Peloquin Chambers, 18 St. Augustine's Parade, Bristol 1. *Telephone: 20351.*
LEEDS: 26-27 Park Row, Leeds 1. *Telephone: 33621.* **LONDON:** Bush House, Aldwych, W.C.2. *Telephone: Temple Bar 8430.*
LUTON: 57 Bute Street. *Telephone: 7364-5.* **SOUTHAMPTON:** 16 Cumberland Place. *Telephone: 25425.*
MANCHESTER: 23 Princess St., Manchester 2. *Telephone: Central 9335.* **NEWCASTLE UPON TYNE:** Groat House, Collingwood St., Newcastle upon Tyne 1. *Telephone: 20878*



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Maybe you do not need the fine limits to which we supply millions of pressed metal parts for ROLLS-ROYCE LTD., BURGESS MICROSWITCHES, PARMEKO, etc., but whatever your tolerances, quantities, shapes or sizes, if you require consistent precision and reliability of service get into touch with us for

PRECISION METAL PRESSINGS

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(Member of the Bentley Group) Telephone: Leicester 32233

ES 27

***Amalgam* RESINACT—**
A supremely efficient solder

Write to us for a sample of this A.I.D. approved, activated solder wire with non-corrosive RESINACT core. It is specially designed for all electrical work and is available to any specification in sizes from 4-22 W.G.
We are specialists in all forms of fusible alloys.

GREY & MARTEN LTD
ESTABLISHED 1833
CITY LEAD WORKS · SOUTHWARK BRIDGE · S.E.1
Telephone: HOP 0414 Telegrams: Amalgam, Sedist, London
and at Birmingham and Ipswich

resistance wire and tape

of highest grade in

NICKEL CHROMIUM
NICKEL CHROMIUM IRON
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PURE NICKEL
STAINLESS STEEL
AND TITANIUM WIRE

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ALLOY WIRE CO. LTD.
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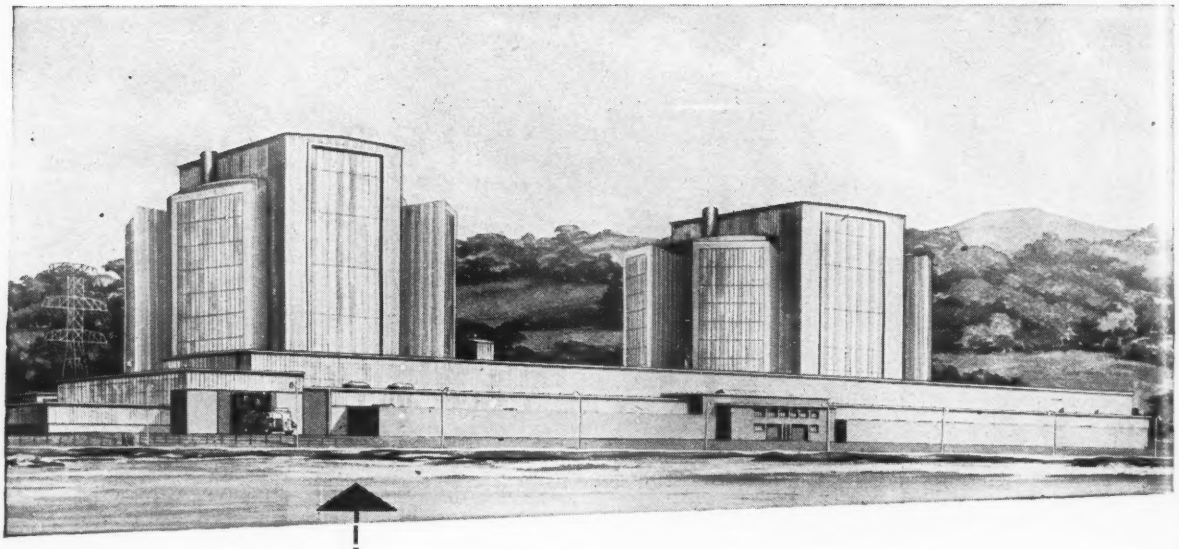

For the South of Scotland Electricity Board

The full resources of the Group are being brought to bear on the construction of a 320 MW nuclear power station.

For the United Kingdom Atomic Energy Authority

The Motherwell Bridge & Engineering Company Ltd. (a member of the Group) is building at Dounreay, Scotland, the reactor-containing sphere for the world's first fast breeder reactor. The G.E.C. is installing the electrical generating plant.

Shaping the pattern of the nuclear future

The G.E.C.—Simon-Carves Atomic Energy Group is already engaged in two major nuclear power projects of world significance.

G.E.C.
SIMON-CARVES
ATOMIC ENERGY GROUP
ERITH • KENT

THE GENERAL ELECTRIC CO. LTD • SIMON-CARVES LTD.
THE MOTHERWELL BRIDGE & ENGINEERING CO. LTD.
JOHN MOWLEM & CO. LTD.

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue and should be addresssed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

LONGBENTON URBAN DISTRICT COUNCIL

Public Street Lighting
at
Dudley Lane, Seaton Burn

TENDERS are invited for the supply and erection of 23 Sodium Vapour Street Lighting Units, mounted on concrete columns, at Dudley Lane, Seaton Burn, from Great North Road eastwards to Weetslade Cemetery.

Plans can be inspected at the office of the Engineer and Surveyor and specifications, schedule and form of tender can be obtained on application to Mr. A. E. Sweetman, M.I.Mun.E., Engineer and Surveyor, Council Offices, Forest Hall, Newcastle upon Tyne, 12, on a payment of a deposit of £2 2s., returnable only on receipt of a bona fide tender not subsequently withdrawn and the return of all the documents loaned.

Tenders in a plain sealed envelope endorsed "Public Street Lighting" must be delivered to the undersigned not later than 10 a.m. on 13th July, 1957.

The Council do not bind themselves to accept the lowest or any tender and reserve the right to divide the contract should they so desire.

G. HARRISON,
Clerk to the Council.

June, 1957. 6436

BOROUGH OF STRATFORD-UPON-AVON

Bath-Lincoln Trunk Road, A.46, A.422, A.439

Street Lighting

TENDERS are invited for :—

(a) Supply of 40 25′ steel columns.
(b) Erection and wiring of 40 25′ columns and supply of 61 lanterns for 500-w. tungsten lamps, with 56 time switches, fuses, etc.

Contractors may tender for either section (a) or (b) or for both parts.

Specifications, bills of quantities and forms of tender may be obtained from the undersigned on payment of a deposit of £2 2s., which will be returned on receipt of a bona fide tender.

Tenders must be delivered to the Town Clerk, 2, Sheep Street, Stratford-upon-Avon, not later than noon on Friday, 26th July, 1957.

The Council do not bind themselves to accept the lowest or any tender.

P. C. SMART, M.I.C.E.,
Borough Engineer and Surveyor.

Municipal Offices,
Stratford-upon-Avon.
21st June, 1957. 6457

GOVERNMENT OF NEW ZEALAND

Ministry of Works

Wairakei Geothermal Project

TENDERS will shortly be required for the supply f.o.b. or ex works in New Zealand of 11,000, 3,300 and 400-volt paper insulated mass impregnated cables of the non-draining type, also 400-volt P.V.C. insulated and sheathed power and multicore cables.

Interested firms should apply to MERZ and McLELLAN, Milburn, Esher, Surrey, for full particulars preferably by 1st July, 1957. No further announcement will appear and suppliers should regard this notice as the formal invitation to tender. 6385

BOROUGH OF SOLIHULL

Group "A" Street Lighting

Hampton Lane (B.4102)
Lode Lane & Hobs Moat Road

TENDERS are invited for the provision and installation of 64 lighting units, including 25-ft. concrete columns, 140-watt sodium lamps, lanterns and control gear, and for the conversion of 73 lighting units from tungsten to 140-watt sodium.

Specifications, bills of quantities, forms of tender, etc., may be obtained from, and drawings and general conditions of contract may be inspected at, the office of the Borough Engineer, 90, Station Road, Solihull, on deposit of a fee of two guineas, returnable on receipt of a bona fide tender not subsequently withdrawn.

Tenders, sealed in the official envelope provided, must be returned to the undersigned not later than noon on Monday, 8th July, 1957.

The Council do not undertake to accept the lowest or any tender.

W. MAURICE MELL,
Town Clerk.
6437

COUNTY COUNCIL OF ESSEX

Clacton County High School

Renewal of Electrical Installation

THE Education Committee of the County Council of Essex invites contractors who are willing to tender for the above contract to submit their names.

The work consists of the renewal of the electrical installation using as much existing material as possible and must be commenced August, 1957. The approximate value of the contract is £3,575.

From the names submitted a panel of contractors will be chosen who will subsequently be provided with specifications.

Contractors' applications should be sent to reach the undersigned not later than Saturday, 6th July, 1957.

H. CONOLLY,
C.B.E., F.R.I.B.A.,
County Architect.

County Hall,
Chelmsford.
June, 1957. 6414

COUNTY BOROUGH OF IPSWICH

TENDERS are invited for the Electric Light and Power installation in the Civic College Workshops extensions.

Applications for tender documents, specifications and drawings should reach the Consulting Engineers, Messrs. Barlow, Leslie & Coombes, 5, Catherine Place, London, S.W.1, not later than 10th July, 1957.

Tenders in plain sealed envelopes bearing the words "Civic College Workshops Electrical Installation," but with no name or mark to indicate the sender, must be received by me not later than 24th July.

J. C. NELSON,
Town Clerk.

Town Hall, Ipswich.
28th June, 1957. 6473

AUCHTERMUCHTY TOWN COUNCIL

TENDERS are invited for the supply and erection of 35 steel columns, brackets, sodium lanterns, and ancillary gear for group A standard street lighting.

Tender documents, obtainable from Mr. George Mark, Burgh Surveyor, 21, St. Catherine's Street, Cupar, must be returned marked "Street Lighting, Auchtermuchty," by noon on 13th July, 1957, to Mr. Ian W. McInnes, Town Clerk, National Bank Buildings, Cupar, Fife. 6435

SITUATIONS VACANT

CENTRAL ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments at TILBURY GENERATING STATION, TILBURY, ESSEX:—

The station which is at present under construction will have an ultimate capacity of 360 MW when the salaries will increase from Class J to Class K.

ASSISTANT ENGINEER (Operation).

Salary Class J, Grade 12, £830 × £15 to £885 per annum inclusive of London weighting plus 10% shift allowance.

The duties will involve the supervision and control of boiler/turbine units on a shift basis.

Candidates should have had experience in the operation of modern boiler and turbine plant. Technical qualifications and training in combustion and/or steam utilisation efficiency control will be an advantage.

The appointment will provide good operating experience, with prospects of promotion for suitable engineers.

GENERAL ASSISTANT ENGINEER.

Salary within the range of Class J, Grade 17, £580 × £15 to £625 per annum, and Grade 14, £725 × £15 to £770 per annum inclusive of London weighting plus 10% shift allowance.

Duties, including periods of shift duty, involve assisting in the operation, testing, efficiency control, and maintenance of electrical, boiler and turbine plant and provide a suitable basis for promotion to higher technical grades.

Manual workers in skilled grades with suitable technical training will be considered. Previous experience in a generating station and/or technical training to the standard of Ordinary National Certificate or its equivalent will be of advantage.

Applications, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Authority, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., to arrive not later than 6th July, 1957.

W. N. C. CLINCH,
Controller.
6417

MORPHY-RICHARDS LIMITED

St. Mary Cray, Orpington, Kent

METHODS ENGINEER to prepare plant and methods layouts for machine and assembly shops. Age 30 upwards. H.N.C. or O.N.C. Experience of flow production techniques is needed, and an apprenticeship or toolroom background would be an advantage.

DEVELOPMENT LABORATORY TECHNICIANS. Engineers aged 25/35, possessing an electrical engineering degree or H.N.C., are invited to join a team engaged in interesting development projects. Experience in light electro-mechanical equipment is desirable, but the primary requirement is a keen interest in the domestic appliance field.

SENIOR DRAUGHTSMAN for production drawing office. A toolmaking background is preferred, with production design experience in small electrical engineering. H.N.C. or O.N.C. (Mechanical or Electrical) desirable.

These vacancies are brought about by the extension of company activities, and offer unusual prospects for future progress as the current expansion programme develops.

Hours 9 a.m. to 5.30 p.m. 5-day week. Profit-sharing and pension schemes. Please apply to PERSONNEL MANAGER at above address. 6306

Situations Vacant (continued)

CENTRAL ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the following positions in this Division:—

BOILER HOUSE SHIFT CHARGE ENGINEER,
NORTH WILFORD POWER STATION, NOTTINGHAM
(Vacancy No. 97/57/ER).

Applicants should have had a sound technical training, good general engineering experience and a knowledge of the control and operation of large pulverised fuel boilers and associated equipment. Preference will be given to candidates who are in possession of technical qualifications admitting to Corporate Membership of a recognised professional institution.

Salary will be in accordance with Class K, Grade 9 (£995-£1,055 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th July, 1957.

FOURTH ASSISTANT ENGINEER (Section),
NORTHAMPTON TRANSMISSION SECTION
(Vacancy No. 98/57/ER).

Applicants should have experience of the maintenance and operation of high voltage overhead lines, transformer and switchgear up to 132 kV.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/DX, Grade 6 (£710-£910 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th July, 1957.

FOURTH ASSISTANT ENGINEER (Section),
DRAKELOW TRANSMISSION SECTION
(Vacancy No. 99/57/ER).

The section contains extensive 275-kV and 132-kV equipment and the candidates must have had wide experience in the maintenance and operation of 132-kV lines and substations in a transmission section.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/DX, Grade 5 (£810-£1,010 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th July, 1957.

DEPUTY STATION SUPERINTENDENT, WILLINGTON "A" POWER STATION
(Vacancy No. 101/57/ER).

Candidates should have had a wide experience in the operation, maintenance and administration of a modern power station, and a knowledge of pulverised fuel firing will be an advantage.

Preference will be given to candidates possessing technical qualifications leading to Corporate Membership of one of the recognised professional institutions.

Salary will be in accordance with Class K, Grade 3 (£1,560-£1,665 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th July, 1957.

SHIFT CHARGE ENGINEERS, WILLINGTON "A" POWER STATION
(Vacancy No. 102/57/ER).

Candidates should have a sound technical training and considerable experience in a modern generation station. Preference will be given to candidates who are Graduate Members of the Institution of Electrical or Mechanical Engineers, or who hold similar qualifications and knowledge of pulverised fuel firing will be an advantage.

The salary will be in accordance with Class K, Grade 7 (£1,160-£1,235 per annum) of the National Joint Board Agreement, plus 10% for shift duties.

Closing date for receipt of applications, 17th July, 1957.

PLANT CONTROL ENGINEERS, WILLINGTON "A" POWER STATION
(Vacancy No. 103/57/ER).

Candidates should have a sound technical training and experience of the operation of a power station, including electrical control room experience.

Preference will be given to candidates who possess technical qualifications to Higher National standard, and experience of pulverised fuel firing will be an advantage.

The salary will be in accordance with Class K, Grade 10 (£935-£995 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 17th July, 1957.

SECOND ASSISTANT CHEMIST, CASTLE DONINGTON POWER STATION
(Vacancy No. 104/57/ER).

Candidates should have had previous experience in a power station laboratory and should hold the Higher National Certificate in Chemistry. They should be familiar with the methods of sampling and analysis of coal, water, oil and other materials and with the interpretation and application of the analytical results.

Salary and conditions of service will be in accordance with Class L, Grade 11 (£935-£995 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th July, 1957.

FOURTH ASSISTANT ENGINEER (Telecommunications),
TECHNICAL DEPARTMENT
(Vacancy No. 105/57/ER).

Applicants should hold the Higher National Certificate in Electrical Engineering or telecommunications qualifications of equivalent standard.

Practical experience in the maintenance and operation of automatic telephone type apparatus and circuits is essential. Knowledge of V.F. equipment or electronics is also desirable.

The salary will be in accordance with Class AX/DX, Grade 6 (£710-£910 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 3rd July, 1957.

These appointments will be pensionable within the provisions of the Central Electricity Authority and Area Boards (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Authority, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.

19th June, 1957. 6418

CENTRAL ELECTRICITY AUTHORITY

Yorkshire Division

APPLICATIONS are invited for the following appointments :—

FOURTH ASSISTANT ENGINEER, EFFICIENCY AND TESTING SECTION, LEEDS.

Applicants should be educated to Higher National Certificate standard in mechanical engineering and should preferably have had experience of operation in modern power stations.

Duties will include assisting with the testing of power station plant throughout the Division, and the preparation of reports. The successful applicant will be based at Skelton Grange Power Station, but will be expected to travel in connection with his duties.

FOURTH ASSISTANT ENGINEER, SYSTEM OPERATION DEPARTMENT, LEEDS.

Duties are of a general technical and statistical nature in connection with system operation and control. Preference will be given to candidates who hold the Higher National Certificate in Electrical Engineering or equivalent qualifications. Experience in a generating station will be an advantage.

Commencing salary for both appointments within the range £710-£835 per annum, Grade 6, Class AX, National Joint Board Agreement (Schedule B), according to qualifications and experience, rising to an ultimate maximum of £935 per annum (Class EX).

Application forms obtainable from the Divisional Secretary (Establishments), Central Electricity House, St. Mary's Road, Leeds, 7, to be returned within 14 days of the appearance of this advertisement. 6470

CENTRAL ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or B. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (a) and Corporate Membership for post (b) an advantage.

(a) EFFICIENCY ENGINEER (Testing), ACTON LANE POWER STATION
(Vacancy No. 57/553).

Experience in plant testing and heat calculations desirable. Salary Class J, Grade 9 = £985 p.a. Applicants to vacancies 57/239, 57/287 and 57/353 need not re-apply.

(a) ASSISTANT ENGINEER (Shift) (3.3-kV Switchboard), BATTERSEA POWER STATION
(Vacancy No. 57/554).

Sound engineering training necessary followed by some experience in modern power station. Salary Class L, Grade 15 = £780 p.a. + £74 p.a. shift allowance. Applicants to vacancy 57/413 need not re-apply.

(b) BOILER HOUSE SUPERINTENDENT, BATTERSEA POWER STATION
(Vacancy No. 57/555).

Sound engineering training necessary with experience of modern H.P. plant together with good knowledge of personnel management. Salary Class L, Grade 6 = £1,375 p.a.

CHEMICAL ASSISTANT, DEPTFORD WEST POWER STATION
(Vacancy No. 57/556).

Candidates should have G.C.E. at advanced level and be interested in investigational work in laboratory and on power station plant. Salary range £300 (age 18) to £560 (age 22) p.a. with variations on obtaining a degree and completing National Service.

(a) ASSISTANT ENGINEER (Efficiency and Testing), WEST HAM POWER STATION
(Vacancy No. 57/557).

Applicants should have had a good technical education and experience in the investigation of the technical problems of power station operation. A knowledge of plant testing and operating statistics is desirable. The duties will include keeping check on all matters associated with the thermal efficiency of the station. Salary Class H, Grade 11 = £830 p.a.

(a) THIRD ASSISTANT ENGINEER, OPERATIONAL RESEARCH, DIVISIONAL H.Q.
(Vacancy No. 57/558).

Candidates should be young engineers with H.N.C. as minimum qualification and should have flair for investigation. A knowledge of method study techniques whilst useful is not essential as training can be arranged. Salary Class AX/EX, Grade 4 = £945 to £1,190 p.a.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, Central Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland Street, London, W.1, and be received within 10 days of this advertisement. 6441

CENTRAL ELECTRICITY AUTHORITY

South Western Division

Technical Staff Vacancies

(a) ASSISTANT SHIFT CHARGE ENGINEER, PORTISHEAD B POWER STATION. N.J.B. J.9, £935-£995 (plus 10% shift allowance). Ultimate classification of station K.

(b) STATION SHIFT CONTROL ENGINEER, PLYMOUTH A POWER STATION. N.J.B. F.10, £740-£785 (plus 10% shift allowance).

Superannuation scheme.

Applicants for:—

(a) should have had sound technical training and practical experience in a modern power station.

(b) should possess good technical qualifications, and have had training and experience in the control and operation of steam generating plant and main switchgear.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 8th July, 1957. 6467

WESTERN REGIONAL HOSPITAL BOARD, SCOTLAND

APPLICATIONS are invited for the following appointments:—

DEPUTY REGIONAL ENGINEER.

Applicants should be engineers of professional standing and should be Corporate Members of the Institution of Mechanical Engineers, Institution of Electrical Engineers or Institution of Civil Engineers with wide experience of all branches of hospital engineering, design and operation. The person appointed will be required to act for the Regional Engineer over the whole range of the services for which the engineer is responsible and be able to advise the Board in the absence of the Regional Engineer. He will also be responsible for the day-to-day supervision of the engineering departments of the board's works organisation.

Salary scale £1,345 × £55 (2) × £50 (2) × £35 (1) to £1,590.

ASSISTANT ENGINEERS.

Applications are invited for two posts of Assistant Engineer for electrical and heating duties respectively. Applicants should be Corporate Members of, or have obtained the technical standard of Corporate Members of, the Institutions of Electrical Engineers or Heating and Ventilating Engineers respectively and should have practical and theoretical experience of design, installation and operation and general maintenance and should be capable of assisting in preparing specifications and estimates and advising generally on the classes of plant in their own particular field, viz.,

(a) Electrical.
Electrical installation, including heating, lighting and power, and

(b) Heating.
Heating, ventilating, hot water, air conditioning, refrigerating, sterilising and pipe work installations in large buildings, laundries, kitchens, etc.

Salary scale £680 × £25 (3) × £30 (2) × £35 (1) × £30 (1) × £35 (3) to £985.

CLERK OF WORKS
(Electrical and Mechanical).

Applicants should have served an apprenticeship in mechanical or electrical engineering and have had not less than five years' experience supervising site installations, employing trades associated with mechanical heating and ventilating and/or electrical engineering.

Salary scale £615 × £22 (2) × £25 (3) to £730.

The successful applicants will be required to pass a medical examination and all appointments are subject to a deduction at the rate of 6% per annum for superannuation. In the case of the Deputy Regional Engineer the appointment will be subject to three months' notice of termination on either side and in the other appointments two months' notice on either side is required.

Applications, giving particulars of qualifications and experience, together with the names of three referees, should be lodged with the Secretary, Western Regional Hospital Board, 64, West Regent Street, Glasgow, C.2, not later than 20th July, 1957. 333

SALES MANAGER
(Domestic Appliances)

APPLICATIONS for this post are invited by THE REVO ELECTRIC COMPANY LIMITED, TIPTON, STAFFS.

This appointment calls for a man with personality, drive, initiative and common sense, who has first-class experience in the direction and control of a national sales force. He should also be fully conversant with all aspects of up-to-date marketing, sales promotion and advertising techniques. Experience in the marketing of durable consumer goods, industrial equipment or allied products is desirable but not essential. The successful candidate will possess qualities of leadership and organising ability of a high order; he will also be expected to have an appreciation of other management functions in order to act as a member of a co-ordinated team.

There are considerable prospects for the right man and the salary will be commensurate with the responsibility of the appointment. A car will be provided and a pension scheme is in operation.

All applications, which will be treated in strict confidence, should be sent to the Managing Director, marked "Private and Confidential," and should contain full details of the candidate's career in chronological order, together with salaries received. 6445

CENTRAL ELECTRICITY AUTHORITY
Headquarters

ENGINEERS required in the Station Planning and Development Branch in London, S.E.1.

The branch is responsible for (a) investigation and selection of sites for nuclear power stations; co-ordination of investigations and selection of sites for orthodox stations; negotiations for statutory and other consents for both classes of stations; (b) formulation of initial basic designs of new orthodox power stations including layout of sites and stations; railway sidings; circulating water systems; development of works power supply schemes; plant control schemes.

All candidates should have an Honours Degree or qualifications for membership of the I.Mech.E., I.C.E. or I.E.E. and for (a) preferably experience of economic studies or of one or more of the problems arising in the siting of power stations, e.g. geology and ground exploration; thermal and hydraulic aspects of the use of river and sea water for cooling purposes; discharge and dispersal of chimney emissions; questions of town and country planning. Candidates for (b) must be experienced in the design and layout of large modern power stations and associated plant, and experience of the construction or operation of such stations would be an advantage.

Salaries within scales:
SENIOR ASSISTANT ENGINEER, £1,435-£1,795 p.a.
SECOND ASSISTANT ENGINEERS, £1,210-£1,570 p.a.
THIRD ASSISTANT ENGINEER, £1,105-£1,315 p.a.
FOURTH ASSISTANT ENGINEER, £870-£1,045 p.a.

Application forms, obtainable from D. Moffat, Director of Establishments, Winsley Street, London, W.1, should be completed and returned by 11th July. Quote ref. E.R./281. 6440

SOUTH EASTERN ELECTRICITY BOARD

CARTOGRAPHIC DRAUGHTSMAN (Grade 2), Tunbridge Wells District.

Salary £600 × £20 to £660 p.a. under N.J.C. Grade 2. Superannuable. Applicants should be experienced in the preparation of mains records and development plans. Knowledge of "notice" procedure under the Public Utilities Street Works Act and of overhead line survey work would be an advantage.

Applications naming two referees, to T. W. Dann, M.Eng., M.I.E.E., Town Hall, Tunbridge Wells by 8th July, 1957.

A. L. BURNELL,
Secretary.
6465

NORTH WESTERN ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER (Power Sales), SUB-AREA CONSUMERS' ENGINEER'S DEPARTMENT, MANCHESTER. Applicants should have practical training in industrial electrification. Preference will be given to applicants holding H.N.C. in Electrical Engineering.

Salary scale £885 × £15 to £930 p.a. Grade M.13. N.J.B. conditions.

Applications, naming three referees, to Sub-Area Secretary, No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, 2, P.O. Box 493, by 8th July, 1957. 6419

WORKS MANAGER

required by old-established firm near Glasgow. New works have recently been purchased and equipped and successful applicant must be capable of organising and developing increased turn-over. Preference given to applicant with some electrical background.

Give brief details of general education, technical and works trainiing and salary required to—Box 6424.

SWITCHGEAR DESIGNER

required for development work. Applicant should have H.N.C. or equivalent with preferably switchgear design as a supplement. Actual experience of contactor design desirable.

Reply in first instance by letter, giving personal details, experience with dates, and salary desired, to: The Secretary, Veritys Limited, Plume Works, Aston, Birmingham, 6. 6393

PRINCIPAL SCIENTIFIC OFFICERS

THE CIVIL SERVICE COMMISSIONERS invite applications for pensionable posts (a) ADMIRALTY, 9; (b) BRITISH MUSEUM, NATURAL HISTORY, 1; (c) DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, 9; (d) MINISTRY OF SUPPLY, 20. Age at least 31 on 31st December, 1956. Candidates must have 1st or 2nd Class Honours degree, or equivalent, in an appropriate subject and at least three years' approved research experience. Candidates exceptionally well qualified by experience may be admitted without the academic qualifications. For all posts candidates must have had several years' experience and be of proved research ability.

Under (a) 5 posts are for physicists, 1 for a physical chemist, 1 for a mechanical engineer, and 1 for an electrical engineer. The posts are at naval establishments in the southern half of England; duties involve taking charge of research design and development work. There is also a mathematics post for the analysis and reduction of data.

Under (b) a specialist in the taxonomy of European flowering plants is required.

Under (c) three of the posts are at the Laboratories at Teddington, 1 in the Ship Division, 1 in the Radiochemistry Section and 1 in the Metal Corrosion Section; 1 is in the Road Research Laboratory at Langley, Bucks., 1 at the Mechanical Engineering Laboratory at East Kilbride, Near Glasgow, for experimental and theoretical research in hydrodynamics and low speed aerodynamics, 1 at the Low Temperature Research Station at Cambridge for research on food microbiology, 1 in London to act as liaison officer in the field of processing and metallurgy, 1 in Edinburgh to act as liaison officer on matters relating to scientific research and development. The work entails extensive travelling and lecturing, and 1 in London on administrative duties on departments scientific policy and its choice of programmes and allocation of resources.

The posts for (d) are classified under Applied Mathematics, Physics, Aeronautical and Mechanical Engineering, Electrical Engineering, Chemistry, and Metallurgy for work on guided weapons, electronics, aerodynamics, radio, radar, etc.

Fuller information about the duties and the kind of experience expected is given in the memorandum.

Salary (London) minimum £1,375 (women £1,288). Men's scale maximum £1,950. Exceptionally, starting pay above minimum. Somewhat lower outside London. Women's scale is being raised to reach equality with men's by 1961.

Application forms and memorandum from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting S4714/57/11. Applications to be returned by 18th July, 1957. 6386

CITY COUNCIL OF SINGAPORE

APPLICATIONS are invited for appointment of INSTRUMENT ENGINEER in the Electricity Department on agreement for 3 years' resident service.

Applicants must be G.I.E.E. or hold H.N.C. (Elect.), or equivalent and must have experience in the calibration, servicing and repair of instruments and auto-combustion control gear used in modern power station practice, have thorough knowledge of the principles of combustion and of fully automatic boiler control and be able to supervise and train staff. Minimum age 25 years.

The monthly basic salary offered is $820 for the first, $850 for the second and $880 for the third year of resident service. ($1 Malayan = 2s. 4d.) Expatriation and variable allowances also payable. Total emoluments with current allowances on basic salary of $820 p.a. are equivalent to £1,561 per annum for a single man, £1,687 p.a. for a married man with no children and £1,779 p.a. for a married man with one or more children. Gratuity equivalent to 20% of basic salary payable on satisfactory completion of the 3 years' resident service. Partly furnished quarters at a rental of 12½% of basic salary provided if available. Air passages paid including family subject to certain limits. Home and local leave.

Further details from the Council's London Agents: Messrs. Allen & Williams, 1, Victoria Street, Westminster, London, S.W.1. Closing date for full applications in DUPLICATE, Thursday, 18th July, 1957. 6443

Situations Vacant (continued)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts :—

North Staffordshire Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER (Leek).

Candidates should have had experience in the operation and maintenance of distribution systems. Technical qualifications desirable. Salary £740/£785 per annum (N.J.B. Grade E.9).

Apply by letter within fourteen days, stating age, experience, present salary and position, to the District Manager, Midlands Electricity Board, Station Street, Leek, Staffs.

South Staffs. and North Worcs. Sub-Area

THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER (Smethwick).

Applicants should have had wide practical experience in the sale and installation of domestic and commercial electrical equipment and the work associated therewith. The successful applicant will be required to assist in all branches of commercial work, including advising consumers on domestic, commercial and industrial equipment, estimating and contracting work. Salary £790/£835 per annum (N.J.B. Grade G.10).

Apply by letter within fourteen days, stating age, experience, present salary and position, to Mr. T. G. Keeler, Sub-Area Manager (Ref. CW), Midlands Electricity Board, P.O. Box No. 9, Toll End Road, Tipton, Staffs.

Central Gloucestershire Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER (Gloucester District).

Applicants should have had a sound technical training and experience in the construction, operation and maintenance of overhead and underground distribution systems. Technical qualifications desirable. Salary £790/£835 per annum (N.J.B. Grade F.9).

Apply by letter within fourteen days, stating age, experience, present salary and position, to Mr. S. Raybould, Sub-Area Manager, Midlands Electricity Board, 126, London Rd., Gloucester.

A. STEPHENS,
Secretary. 6472

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the following positions in the Generation/Construction Section of the Chief Engineer's Department:

1. SECOND ASSISTANT ENGINEER (Civil) (Ref. E28/57).

Applicants should have a sound civil engineering training and should hold a degree in Civil Engineering, be a Corporate Member of the Institution of Civil Engineers or possess equivalent qualifications. Candidates should also have experience in the preparation of specifications and estimates and a knowledge of the design and construction of civil works in connection with large generating stations.

Salary N.J.B. Schedule B, Class AX/DX, Grade 2, £1,145/£1,375 per annum.

2. FOURTH ASSISTANT ENGINEERS (Civil) (Ref. E29/57).

Applicants should have a sound civil engineering training to at least Higher National Certificate standard or equivalent. Previous experience in the design or construction of civil engineering works connected with generating station projects will be an advantage.

Salary N.J.B. Schedule B, Class AX/DX, Grade 6, £710/£910 per annum.

3. FOURTH ASSISTANT ENGINEERS (Plant) (Ref. E30/57).

Applicants should have a sound engineering training in either mechanical or electrical engineering to at least Graduate I.E.E. or I.Mech.E. standard. Experience in the construction or operation of large generating stations will be an advantage.

Salary N.J.B. Schedule B, Class AX/DX, Grade 6, £710/£910 per annum.

The positions are superannuable. Applications, quoting appropriate reference, should be submitted on the standard form, which may be obtained from the undersigned, and returned not later than Friday, 5th July, 1957.

J. MEEK,
Secretary.

P.O. Box 173,
351, Sauchiehall Street,
Glasgow, C.2. 6464

CENTRAL ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the following positions :—

FOURTH ASSISTANT ENGINEER (Transmission), Reading Section (S/13.926).

Applicants should preferably have had some experience in the maintenance and/or operation of overhead lines. Preference will be given to those with a suitable works training on high-voltage switchgear and transformers.

Applicants should possess a Higher National Certificate or its equivalent, and preferably possess or be studying for qualifications leading to corporate membership of an appropriate professional institution.

Salary N.J.B. AX/CX, Grade 6, £710-£885 per annum.

GENERAL ASSISTANT ENGINEERS (S/13.927).

Applicants should have served an apprenticeship or had practical training suitable to the industry. They should possess a sound general and technical education, and preference will be given to those possessing a Higher National Certificate (or those nearing completion of H.N.C. courses). Opportunities are available for general assistant engineers to complete their studies and gain wide experience with good prospects of promotion.

The duties of those appointed will vary, but will include as a general rule the operation and control, under supervision, of generating plant. A number of these vacancies are at the oil-firing stations at Marchwood, near Southampton, and Poole.

Vacancies also exist for those who wish to specialise in maintenance of electrical and mechanical generating plant, transmission lines, substations and cables, or generating station construction work.

Salary N.J.B. within scale £540-£730 per annum.

Special application forms for the above vacancies obtainable from P. D. A. Oliver, Divisional Secretary, 111, High St., Portsmouth, should be returned by 10th July, 1957. 6471

JOSEPH LUCAS (ELECTRICAL) LTD.

Great King Street, Birmingham

AS a result of expansion of our road vehicle lighting development department to meet the growing demands of the motor industry we have vacancies for

ENGINEERS AND PHYSICISTS

of at least H.N.C. standard to work on the following projects. Experience or knowledge of photometric and electrical instruments desirable.

The design and development of vehicle lighting equipment and in particular the development of optical systems for future projects.

Development work on specific problems related to vehicle lighting equipment and the design of laboratory and factory control equipment for these products.

In addition there are vacancies for SENIOR DESIGNERS required to work in close co-operation with car designers and styling engineers on the design of lighting equipment for new car models. Experience in the design of pressed metal components for large quantity production desirable.

All of these positions carry attractive starting salaries and provide excellent prospects for advancement. Staff pension fund.

Apply in writing, stating age, qualifications and experience, to the Personnel Manager, Joseph Lucas (Electrical) Limited, Great King Street, Birmingham, 19, quoting reference PM/D/156.

6392

CLASSIFIED ADVERTISEMENTS ARE PREPAID

UNIVERSITY OF THE WITWATERSRAND

Johannesburg, South Africa

APPLICATIONS are invited for the positions of SENIOR LECTURER and LECTURER on the staff of the DEPARTMENT OF ELECTRICAL ENGINEERING.

SENIOR LECTURER: Applicants must be able to teach electrical machine theory, power circuit theory, and to give laboratory instruction in the electrical machine theory. The department has facilities for research in electrical machines and in high voltage electrical engineering.

LECTURER: Applicants must be able to teach general telecommunications and network theory, and electromagnetic theory. He will also be required to give laboratory instruction in the telecommunications and electronics laboratories.

Salary scales: Senior Lecturer, £1,200 × £50 to £1,500 per annum.
Lecturer, £850 × £50 to £1,200 per annum.

Cost-of-living allowance: Payable in terms of Union Government regulations to persons with dependants. The present rate for a married man is £234 per annum.

Membership of the University Institutions' Provident Fund is compulsory and involves a contribution at the rate of 7% of the salary paid. Membership of the Staff Medical Aid Fund is obligatory in the case of an officer who is eligible for membership in terms of the rules of the fund.

Applicants are advised to obtain a copy of the information sheet relating to these vacancies from the Secretary, Association of Universities of the British Commonwealth, 36, Gordon Square, London, W.C.1.

Applications close in South Africa and London on 12th August, 1957. 6423

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

SHEFFIELD NORTH DISTRICT FOURTH ASSISTANT DISTRICT ENGINEER,
Two Posts.

Applicants should be technically qualified up to Higher National Certificate level, and should have experience of distribution engineering on systems up to 11 kV.

Salary N.J.B. Class K, Grade 11, £885/£15/£930 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 12th July, 1957.

No. 7 (Grimsby) Sub-Area

THIRD ASSISTANT ENGINEER (Commercial).

Applicants should preferably have had a technical education up to Higher National Certificate standard in Electrical Engineering and have experience of industrial supplies. Some knowledge of street lighting would be an advantage.

Salary N.J.B. Class J, Grade 10, £885/£15/£930 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than 12th July, 1957. 6462

SOUTH OF SCOTLAND ELECTRICITY BOARD

Fife Area

APPLICATIONS are invited for the following posts at Area Headquarters.

1. THIRD ASSISTANT PLANNING ENGINEER.
2. THIRD ASSISTANT CONSTRUCTION ENGINEER.

The successful applicant, who should preferably hold the Higher National Certificate in Electrical Engineering, will be required to reside on or near Dunfermline. N.J.B. salary and conditions, Class G, Grade 10. Salary £790 × £15 to £835.

Applications on standard form obtainable from the undersigned should be lodged not later than Saturday, 13th July, 1957.

G. T. ALLCOCK,
Area Manager.

East Port,
Dunfermline. 6466

BOROUGH POLYTECHNIC
Borough Road, London, S.E.1

Principal: James E. Garside, M.Sc.Tech., Ph.D., F.R.I.C., F.I.M., M.Inst.F.

DEPARTMENT OF ELECTRICAL ENGINEERING AND PHYSICS
Head of Department: V. P. Mendoza, M.Sc.Tech., M.I.E.E.

THE Governors invite applications for the following posts:—

ASSISTANT LECTURER (Grade B). Applicants should be Graduates in Electrical Engineering and/or hold equivalent professional qualifications. Teaching duties largely in connection with H.N.C. and O.N.C. courses but if suitably qualified could also participate in Dip.Tech. courses.

ASSISTANT LECTURER (Grade A). Minimum qualification Grad.I.E.E. Teaching duties largely with O.N.C. and full-time installations classes.

Teaching and/or industrial experience in electrical engineering is required for both posts.

Salary, Grade B, £650 × £25 to £1,025 p.a., plus London allowance; Grade A, £475 × £25 to £900 p.a., plus London allowance.

Commencing salary above minimum of scale determined by teaching and/or industrial experience, training and qualifications.

Further particulars of the above posts, and forms of application available from the undersigned.

FREDERICK J. PACKER,
Clerk to the Governing Body.
6453

IMPERIAL CHEMICAL INDUSTRIES LIMITED

WILTON WORKS

ENGINEERING DESIGNERS

who possess Higher National Certificate or its equivalent, and who have experience in the following branches of engineering:

MECHANICAL, CIVIL,
ELECTRICAL, STRUCTURAL,
ARCHITECTURAL,
HEATING and VENTILATING,

are required to fill immediate vacancies in the design office. Over 4,700 men are at present employed on the design and construction of the works, which has its own power station.

Commencing salaries up to £900 per annum. Profit sharing scheme and pension fund. Housing. After joining the staff married men will receive a reasonable refund of removal (including travel) expenses and, to assist them in house purchase, facilities are available in approved cases for substantial loans. In addition legal charges will be advanced.

The design offices are situated in the parklands of Wilton Castle which lies at the foot of the Cleveland Hills.

Please write to me: Staff Manager, Imperial Chemical Industries Limited, Wilton Works, Middlesbrough, Yorkshire, quoting reference 401/6.

6361

CENTRAL ELECTRICITY AUTHORITY

Nuclear Power Sub-Department

SENIOR ASSISTANT ENGINEER required in the Mechanical Design Section in London, S.E.1. Duties will mainly be concerned with the design of reactor pressure vessels, boilers, and gas ducting for current nuclear power stations.

Candidates should have a University Degree and/or be members of a Senior Engineering Institution and have experience of design and manufacture of boiler plant. Knowledge of design and fabrication of large pressure vessels desirable.

Salary within scale £1,435-£1,795 p.a. according to ability. Application forms, obtainable from D. Moffat, Director of Establishments, Winsley Street, London, W.1, to be returned by 20th July. Quote ref. E.R./283.

6468

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Planning)

SUB-Area Engineering Department, Waterloo Road, Uxbridge, of No. 1 (Southall) Sub-Area. Salary N.J.B. Class L, Grade 13 (£885-£930 per annum inclusive of London allowance). N.J.B. conditions of service.

The duties of the post will be to assist in the preparation of schemes and estimates for extensions and/or reinforcements to overhead and underground H.V. and L.V. networks.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him in envelopes suitably endorsed not later than 8th July, 1957.

General Assistant Engineer

Sub-Area Engineering Department of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class L, Grade 18 (£590-£635 per annum). N.J.B. conditions of service.

The duties of the post will be principally to assist with the installation and routine testing of metering equipments. An approved technical training and preferably some experience of similar work will be required.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, and returned to him in envelopes suitably endorsed not later than 8th July, 1957.

The successful candidates for the above appointments will be required to contribute to the C.E.A. and Area Boards (Staff) Superannuation Scheme, if eligible. 6463

ENGLISH ELECTRIC COMPANY LIMITED

Guided Weapons Division

ELECTRICAL POWER ENGINEERS with experience of testing, research or system planning, are required, to apply their techniques to the development of the primary power supplies of guided missiles.

H.N.C. or exemption from the A.M.I.E.E. examination would be suitable qualifications.

Applications should be sent to Dr. D. A. Layne, Technical Personnel and Education Officer, c/o Dept. C.P.S., 336/7, Strand, London, W.C.2, quoting reference ER. 618D.

6396

SIERRA LEONE

Provincial Electricity Supplies

ELECTRICAL and MECHANICAL CONSTRUCTION ENGINEER
required

to supervise installation of diesel generating plants and overhead distribution systems in Sierra Leone.

Applicants should be Corporate Members of the Institution of Mechanical or Electrical Engineers and have had previous experience of construction work in the tropics.

Appointment is on contract for one tour of twelve to eighteen months at a salary of £2,000 per annum, plus gratuity of £37 10s. for each completed three months of service.

Single accommodation with heavy furniture provided.

Application to be made on form to be obtained from Messrs. Preece, Cardew & Rider, Consulting Engineers, 8, 10 and 12, Queen Anne's Gate, Westminster, London, S.W.1.

6390

AIR MINISTRY

ASSISTANT MECHANICAL AND ELECTRICAL ENGINEERS required in Works Department for design, operation and maintenance of mechanical and electrical services on R.A.F. stations at home and overseas and Civil Aviation stations.

Salary according to age; £765 at 25 up to £1,030 at 34 or over, thereafter rising to maximum £1,190 London appointment; somewhat lower in Provinces. Promotion prospects. Appointments non-pensionable but with pensionable prospects. 5-day week with 4-6 weeks' leave a year according to length of service. Special allowance up to £1,450 a year, according to location, payable in addition to salary during overseas service.

Candidates normally must be natural-born British subjects of natural-born British parents and age 25 or over. Minimum qualifications and experience: (i) (a) University degree or equivalent diploma in electrical and/or mechanical engineering with at least 2 years' apprenticeship; or (b) Graduate or Corporate Member of I.E.E. with at least 3 years' apprenticeship; or (c) Graduate or Corporate Member of I.Mech.E., appreciable electrical engineering experience, with at least 3 years' apprenticeship, and (ii) have been employed for minimum of three years with well-established engineering concern and gained wide experience in both electrical and mechanical engineering practice.

Forms, quoting reference D.306/6A, from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1. 259

NORTH EASTERN GAS BOARD

Electrical Engineer

APPLICATIONS are invited for the position of ELECTRICAL ENGINEER, under the Chief Engineer, at the Head Office of the Board at Leeds. Candidates must be Corporate Members of the Institution of Electrical Engineers with wide experience in the layout and installation of electrical equipment in works and factories. Experience in gasworks' electrical practice will be an advantage.

The duties will include responsibility for layouts and specifications of electrical equipment, for supervising contractors' installation work and for advising on maintenance work of electrical equipment.

The salary will be within Group D of the National Salaries Tables for Senior Gas Officers, £1,375 to £1,575 per annum.

The appointment is of a permanent nature and the successful candidate will be required to pass a medical examination and to join the staff pension scheme.

Applicants should complete the official application form which may be obtained from, and must be returned to, the Chief Engineer, North Eastern Gas Board, Bridge Street, Leeds, 2, not later than 22nd July, 1957.

J. C. GARDNER,
Secretary. 6421

CITY OF CARDIFF EDUCATION COMMITTEE

Llandaff Technical College

Principal: J. Cotterell, M.I.E.E., A.I.Mech.E., A.M.I.Prod.E., A.M.Brit.I.R.E., M.A.M.E.

DUE to the development of the work of the college, applications are invited for the following new full-time post to commence as soon as possible after the 1st September:—

LECTURER IN ELECTRICAL ENGINEERING.

To teach up to and including O.N.C. level and to be responsible to the Head of the Engineering Department for the professional type electrical engineering courses and the laboratories associated with that type of work. Applicants should have a degree or equivalent professional qualification in electrical power subjects and/or electronics, together with industrial and teaching experience.

Application form and further details may be obtained from the undersigned and should be returned within 14 days of the appearance of this advertisement.

Salary in accordance with the Burnham (Further Education) Report, 1956. Lecturers, £1,200 by £30 to £1,350.

ROBERT E. PRESSWOOD,
Director of Education.
City Hall,
Cardiff. 6420

Situations Vacant (continued)

POWER PLANT SUPERINTENDENT

APPLICATIONS are invited for the position of POWER PLANT SUPERINTENDENT on a large copper mine on the Copperbelt in NORTHERN RHODESIA.

Applicants should have had at least five years' experience as a superintendent of a power plant. The successful candidate will be responsible to the resident engineer for the operation and maintenance of a 30 MW steam generating station, direct fired and waste heat boilers, central coal pulverising plant, steam and electrically driven compressors and blowers, primary water supplies and domestic water purification plant, primary electrical distribution at 66, 11 and 3.3 kV.

The commencing salary will be according to qualifications and experience. The minimum commencing basic salary will be in the region of £1,530 per annum, plus cost of living allowance of approximately £80 per annum and a variable copper bonus, at present approximately 50% of basic salary. There is also a group pension and life assurance scheme.

Married accommodation is available on engagement.

All applications, giving full details of qualifications, experience and marital status to be addressed to R.25, Mine Employment Department, Selection Trust Limited, Mason's Avenue, London, E.C.2. 6284

DIRECTOR OF ELECTRICITY AND TELEPHONES DEPARTMENT ANTIGUA, LEEWARD ISLANDS

TO undertake general administrative control of the department, advise the Government on electrical and telecommunications matters, and be responsible for the operation of the public electricity and telephone service in the Colony.

Contract appointment for three years in first instance. Salary £1,500 p.a. Contract gratuity, 12½% of salary. Free passages for officer, wife and up to three children. Unfurnished quarters at rental of 10% of salary. Generous leave.

Candidates must be A.M.I.E.E., under 45 and have had considerable experience in installation and running of diesel-operated generating stations, construction and maintenance of both overhead and underground H.V. and L.V. lines, the installation and maintenance of distribution transformers, the testing and maintenance of consumers' meters, the installation and maintenance of C.B. and magneto telephone exchanges including subscribers' P.B.X's, the construction and maintenance of overhead and underground telephone lines, the installation and maintenance of subscribers' services, etc. Knowledge of refrigerating plants desirable.

Write Director of Recruitment, Colonial Office, London, S.W.1, giving age, qualifications and experience, quoting BCD 145/34/01. 6389

CENTRAL ELECTRICITY AUTHORITY

South Eastern Division

FOURTH ASSISTANT ENGINEER (Technical Department), DIVISIONAL HEADQUARTERS, KINGSTON. Applicants must possess the Higher National Certificate in Electrical Engineering or equivalent qualification and should be interested in system planning, load flows and fault current calculations.

N.J.B. conditions of service and salary Class AX/DX, £750-£960 per annum including London allowance.

Applications, giving details of education, experience, present position, etc., should be sent to the Establishments Officer, Central Electricity House, Lower Ham Road, Kingston, so as to arrive by 8th July, 1957, quoting reference (205). 6439

LANCASHIRE DYNAMO & CRYPTO LTD.

ESTIMATORS required, preferably with H.N.C. and experience of electric motors, generators and associated equipment, up to 30 h.p. Good salaries will be paid to men with the right kind of experience and existing holiday commitments will be honoured.

Apply giving details of age, qualifications, experience, etc., to

Personnel Officer
LANCASHIRE DYNAMO & CRYPTO LTD.
Acton Lane, London, N.W.10 6305

CENTRAL ELECTRICITY AUTHORITY

Headquarters

REQUIRED in the Drawing Office of the Chief Engineer's Department, Bankside House, Sumner Street, London, S.E.1.

(a) For CIVIL AND BUILDING work.
(b) ELECTRICAL layouts and schematic diagrams.

(a) SECTION LEADER. Salary scale £1,070-£1,170 p.a.

(a) and (b) SENIOR DRAUGHTSMAN (Grade 4). Salary scale £945-£1,045 p.a.

(a) and (b) SENIOR DRAUGHTSMAN (Grade 5). Salary scale £800-£910 p.a.

(a) and (b) ENGINEERING DRAUGHTSMAN. Salary scale £635-£755 p.a.

Salary according to ability and experience.

Permanent pensionable appointments. One Saturday morning in eight on duty. Canteen, sports and social club facilities.

Applications in writing to, or application forms can be obtained from, D. Moffat, Director of Establishments, Winsley Street, London, W.1. Quote ref. E.R./271. 6416

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SENIOR SERVICE CENTRE ASSISTANT required in the Caernarvon District of the Board's No. 4 Sub-Area, based on Bangor. Salary within the range £600/£660 per annum (N.J.C. Grade 2).

Applicants should have a sound training in the electrical retail trade and a wide knowledge of modern electrical appliances for commercial and domestic use. Experience in an electricity undertaking and ability to speak Welsh would be advantageous.

The duties of the post will include the supervision and control of the service centre, display of apparatus and window dressing, hire purchase transactions, and receipt of accounts payable at the service centre.

Appointment subject to medical examination. Pension scheme.

Standard application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, near Wrexham, or at any District Office. Closing date 8th July, 1957. 6458

DEVELOPMENT ENGINEER

THIS Division requires an Electrical Engineer to work on all aspects of the design and development of silicon rectifier equipment using new semi-conductor devices, in the medium power range up to 500 kW.

A degree, or equivalent, preferred, but applicants with H.N.C. (Elec.) minimum will also be considered. Experience on rectifier equipment or allied circuitry is an advantage.

Competitive salary. Non-contributory pension scheme.

Accommodation available a few weeks after engagement.

Household removal expenses paid.

Please write, stating relevant particulars and quoting ref. D.18, to:—

Personnel Manager
STANDARD TELEPHONES AND CABLES LTD.
Rectifier Division
Edinburgh Way, Harlow, Essex
6415

FERRANTI LIMITED, MANCHESTER, have vacancies in their newly established branch at

GORTON

for

DISTRIBUTION TRANSFORMER DESIGNERS

of at least H.N.C. standard for the design of transformers up to 1,500 kVA. Conditions of working are ideal and salaries are based on an attractive scale.

The company operates a staff pension scheme and a dependants' insurance scheme.

Forms of application can be obtained from T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs. Please quote ref. DT. 6460

SOUTH OF SCOTLAND ELECTRICITY BOARD

Edinburgh and Borders Area

Installation Engineer

APPLICATIONS are invited for the appointment of an INSTALLATION ENGINEER for one of the Edinburgh districts. Applicants should have a good knowledge of the organisation and operation of a contracting department, including estimating and costing, and be familiar with domestic, commercial and industrial installation work. Applicants should possess the minimum qualification of the Ordinary National Certificate in Electrical Engineering. Salary scale N.J.B. Class F, Grade 9 (£790-£835 per annum).

Applications on the standard form, which may be obtained from the Secretary, South of Scotland Electricity Board, Edinburgh and Borders Area, 52, Melville Street, Edinburgh, should be completed and returned not later than 19th July, 1957. 6387

UNIVERSITY OF WESTERN AUSTRALIA

APPLICATIONS are invited for the position of LECTURER IN ELECTRICAL ENGINEERING. Applicants should hold a degree in engineering and preference will be given to an applicant with experience or interest in some aspect of heavy power electrical design.

The salary range for Lecturers is £A1,250-£A1,750 per annum plus cost-of-living allowance (at present £43 p.a.); the commencing salary will be determined on the basis of the qualifications and experience of the appointee.

An allowance is made towards travelling expenses and housing assistance is available.

Further particulars and information as to the method of application may be obtained from the Secretary, Association of Universities of the British Commonwealth, 36, Gordon Square, London, W.C.1.

The closing date for the receipt of applications, in Australia and London, is 14th August, 1957. 6422

CENTRAL ELECTRICITY AUTHORITY

Headquarters

ASSISTANT ENGINEER (Scientist) required in the Generation Operation Branch in London, S.E.1, to assist on problems concerning the investigation of atmospheric pollution around power stations. A specialised knowledge of this subject and experience in the use of the microscope in the identification of dust samples an advantage.

Duties involve surveys of atmospheric pollution, the collation of results and fundamental considerations, but will not include laboratory works. There will be opportunities to gain experience of combustion investigations.

Salary within scale £1,105-£1,315 p.a. according to ability.

Application forms, obtainable from D. Moffat, Director of Establishments, Winsley Street, London, W.1, should be completed and returned by 12th July. Quote ref. E.R./268. 6391

RANCO LIMITED

Tannochside, Uddingston, Glasgow

MANUFACTURERS of thermostats, F.H.P. rotor and stator units and relays for refrigeration industry urgently require both SENIOR and JUNIOR ENGINEERS in design section. Applicants should have some previous experience in this field and preferably have had drawing office training and hold either H.N.C. or O.N.C.

This company can offer goods prospects and rates of pay in excellent working conditions.

Please write in first instance, giving details of experience, qualifications, age and salary expected, to Personnel Manager. 6444

WANTED BY NORTH COUNTRY FIRM, man with manufacturing experience of rotary machines covering both A.C./D.C. types up to 25 h.p.

The person called for must have a full technical knowledge relating to this range of equipment, and be capable of giving full technical supervision, including test room for the manufacturing unit concerned.

All applications will be treated with the strictest confidence.—Box 6188.

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SENIOR ASSISTANT (Statistics) required in the Sub-Area Commercial Officer's Department, Hatton Garden, Liverpool.

Salary within range £890/£965 per annum (N.J.C. Grade 6).

Candidates must have knowledge of electricity tariffs, and be capable of dealing with all classes of consumers' enquiries relating thereto. They must also have a sound knowledge of commercial statistics and experience in dealing with the preparation of annual estimates and capital and revenue expenses, load requirements and sale of units and ability to organise this routine.

Appointment subject to medical examination. Pension scheme.

Special application forms obtainable from the Manager, No. 1 Sub-Area, 24, Hatton Garden, Liverpool, 3.

Closing date, 12th July, 1957. 6459

CENTRAL ELECTRICITY AUTHORITY

South Eastern Division

Littlebrook Power Station

ASSISTANT ENGINEER (Efficiency) required at Littlebrook Power Station. The successful applicant will be required to assist in the plant testing and the maintenance of efficiency reports. This position offers excellent opportunity for obtaining general power station experience.

N.J.B. conditions of service, Class L, Grade 14, £830-£885 per annum including London allowance.

Applications, giving details of education, present position, experience, etc., should be sent to the Station Superintendent, Littlebrook Power Station, Nr. Dartford, Kent, so as to arrive by 8th July, 1957, quoting reference (205). 6438

LONDON ELECTRICITY BOARD

General Assistant Engineers

APPLICATIONS are invited for vacancies for GENERAL ASSISTANT ENGINEERS with the London Electricity Board to be located initially at West Ham, E.15.

Applicants should have a sound technical education to the standard of the Higher National Certificate, and have completed a recognised period of training in the electrical industry, or have equivalent experience.

Pending determination as to the grading and salary applicable to the posts within the National Joint Board Agreement, the provisional minimum salary will be £590 per annum rising to £695 per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2. Please quote ref. PER/2343/R. 6366

ELECTRICAL DESIGNER

required by

W. H. ALLEN SONS & CO. LTD.

CANDIDATES should be between 25 and 30 years of age with experience in A.C. motors and alternators. Some knowledge of D.C. machine design would be an advantage.

Generous pension scheme.

Assistance towards removal expenses.

Applications in writing, stating age, experience and salary required, to Personnel Manager, Queens Engineering Works, Bedford. 6335

BRITISH KLOCKNER SWITCHGEAR LIMITED

Chertsey, Surrey

ESTIMATOR for TECHNICAL SALES. Correspondence and capable of preparing control schemes involving automatic motor control gear. Experience essential.

CIRCUIT DIAGRAM DRAUGHTSMAN. Preferably experienced in preparing automatic control gear schemes.

Applicants to have O.N.C. (Electrical). Excellent opportunities with fast growing concern. Pension scheme. Apply to Managing Director, stating experience and present salary. 165

CENTRAL ELECTRICITY AUTHORITY

Headquarters

ASSISTANT ENGINEER (Electrical) required in the Newcastle Regional Office of the Production, Inspection and Test Sub-Branch. Candidates should have qualifications equivalent to Grad.I.E.E. and experience in the production, inspection and testing of power station electrical plant and equipment in the manufacturers' works.

Salary £1,055-£1-265 per annum according to qualifications and experience. Applications stating age, qualifications, experience, present position and salary, to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 5th July. Quote Ref. E.R./282. 6469

SOUTH WESTERN ELECTRICITY BOARD

THIRD ASSISTANT ENGINEER, BRISTOL DISTRICT. Salary N.J.B. J/9 (£935/£995 p.a.).

Duties relate to operation, maintenance and construction work within the district with particular reference to protection, and include supervision of manual workers.

Applicants should have had previous experience of operation on large u/g and o/h networks and possess specialised knowledge of protected systems. H.N.C. or equivalent necessary.

Applications on standard form AE6/ACT, obtainable from Manager, Bristol Sub-Area, Electricity House, Bristol, 1, should be returned by 9th July. 6442

SWITCHGEAR DRAUGHTSMAN

required for development work. Man accustomed to drawing for patterns, jigs, and developing mechanical movements.

Reply in first instance by letter, giving personal details, experience and salary desired, to: The Secretary, Veritys Limited, Plume Works, Aston, Birmingham, 6. 6394

DESIGN ENGINEER

for either D.C. or A.C. medium sized electric motors. The position offers attractive prospects (and assistance towards removal expenses).

Apply, giving particulars of experience and salary required, to: The Secretary, Veritys Limited, Plume Works, Aston, Birmingham, 6. 6395

VENNER LIMITED

require

ELECTRICAL ENGINEERS (LABORATORY) with experience in development of electro-mechanical instruments. Timeswitch experience an advantage.

Salaries and conditions for these staff vacancies are in line with the responsibilities involved, and there is a pension scheme. Fully detailed applications should be addressed to

Personnel Manager
VENNER LIMITED
Kingston By-Pass, New Malden, Surrey 6312

SURREY COUNTY COUNCIL

APPLICATIONS invited for appointment of ELECTRICAL INSTALLATIONS DRAUGHTSMAN, GRADE I, £543 5s. to £625 5s. p.a. plus London allowance of up to £30 p.a. according to age.

Full details, present salary and 3 copy testimonials to County Architect, County Hall, Kingston-upon-Thames, as soon as possible. 6388

BRITISH KLOCKNER SWITCHGEAR LIMITED

Chertsey, Surrey

TECHNICAL SALES ENGINEERS required for London and Home Counties. Knowledge of motor control gear; sales experience preferred but not essential. Apply giving full particulars to—Managing Director. 166

TRANSFORMERS (WATFORD) LIMITED

require

a SENIOR DESIGNER with experience of distribution and medium power transformers. Permanent and progressive position. Generous salary commensurate with qualifications and experience.

Apply:—Chief Engineer, T.W. Ltd., Sandown Road, Watford, Herts. 6311

AN electric cooker designer required by leading manufacturers to work on new projects giving scope for fresh thinking and originality. Good working conditions; London area; pension scheme; salary to attract right man. Present staff notified. Apply—"Designer," Box 6397.

AN engineer with sound knowledge of light electro-mechanical engineering materials and/or finishes required to advise on existing and new materials and processes and to assist with general engineering development and the preparation of specifications. Interesting work, good salary and conditions with an A.E.I. company. Opportunity for responsibility and progress for the right man. State qualifications, experience and salary required to—Staff Officer, Ref. 744/80, Siemens Brothers & Co. Ltd., Woolwich, London, S.E.18. 6176

ADMIRALTY. Trainee electrical draughtsmen required for unestablished appointments in Bath. Candidates must be British subjects aged 21 and upwards and have been apprenticed or had equivalent workshop experience in one or more branches of electrical engineering in factories or shipyards. Free training in drawing and electrical engineering technology for four months beginning September, 1957, at Bath Technical College. Salary during training £475 (age 21) to £615 according to age and experience, increased (except at age 21) on satisfactory completion of training. (These rates are now under review.) Five-day week. 18 days annual leave. Substantial grants towards travelling expenses for all candidates called for interview. Apply, giving details of age, technical qualifications, apprenticeship (or equivalent) and experience, to—Admiralty, CEII (114), Empire Hotel, Bath. 6446

ALBRIGHT & WILSON (MFG.) Ltd., chemical manufacturers, require a senior electrical engineer in the central engineering department, at Oldbury. The duties include preparing estimates, supervising design and the installation of varied electrical equipment including L.T. and E.H.T. switchgear and cables. Candidates aged 30-40, should possess a degree or A.M.I.E.E. and have relevant experience. A good commencing salary will be offered. The company operates a non-contributory pension scheme and a housing scheme. Apply stating age, qualifications and experience to the Staff Officer, Ref. 373, Albright & Wilson (Mfg.) Ltd., P.O. Box 3, Oldbury, Nr. Birmingham. 6474

ARMATURE winders wanted for repair shop. Apply—Minta, Hartley Road, Luton. 9013

ASSISTANT electrical designer required for small and medium size A.C. and D.C. machines. Fractional h.p. experience an advantage. Required minimum qualification H.N.C. Apply giving age, details of experience and salary required to — Personnel Officer, Bull Motors, Foxhall Works, Ipswich. 6102

ASSISTANT electrical engineer. Applicants are invited from men of Grad. I.E.E. standard with a good knowledge of instrumentation, protective systems, electronics and power distribution systems. Preference will be given to applicants with previous paper mill experience. Apply, giving details of age, training and experience, to—Bowaters United Kingdom Pulp and Paper Mills Limited, Thames Division, Northfleet, Kent. 6398

BOOTS PURE DRUG Co. Ltd. require two electrical engineering draughtsmen, age 25-30 years. Commencing salary up to £750 per annum according to qualifications and experience. Five-day week, superannuation scheme. Applications in writing to—Personnel Manager, Station Street, Nottingham. 6447

BRUSH ELECTRICAL ENGINEERING Company Ltd., Loughborough, Leics, require a development engineer to design and develop H.R.C. fuses for the light machines and Fusegear Division. Applicants should hold a H.N.C. in Electrical Engineering, or equivalent qualification, and must have served an approved apprenticeship. They should also have experience of fusegear, but enginers having related experience on circuit interruptions phenomena will be considered. A good salary will be paid and conditions of service include a generous non-contributory superannuation scheme. Please apply to the Chief Personnel Officer. 6475

CHARGE hand required with experience in forming, winding and taping of electric motor armature and field coils. London district. State experience and salary required.—Box 6448.

***Situations Vacant** (continued)*

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Co. Ltd., 24, Fennel Street, Manchester, 4. Electrical surveyors required for various districts in Great Britain. Permanent positions carrying progressive salary scale £675 to £1,000 and non-contributory pension. Candidates, age 26 to 32, preferably with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply in own handwriting, stating age, qualifications and experience. 6452

CHIEF electrician wanted to control maintenance department. Applicants must be experienced in all classes of installation. Maintenance covers lifts, H.T. and L.T. control gear, motors, refrigerators, bakery and dairy plant, etc. Knowledge of I.E.E. rules and appropriate factories acts required. Successful applicant will be responsible for buying and for the oversight of schemes and tenders submitted by other firms for major work. Full details, including age and salary required, should be sent to the Secretary and Executive Officer, Doncaster Co-operative Society Ltd., P.O. Box 20, Doncaster, not later than 5th July, 1957. 9022

CIRCUIT draughtsmen required by firm manufacturing industrial control equipment. Commencing salaries up to £800 per annum for first-class men, but some less experienced draughtsmen required. Canteen facilities, pension scheme, holiday commitments recognised. Housing assistance later to approved cases. West Middlesex area. Write, giving age, experience and full details, to—Box 6434.

CLERK for electrical contractors, Isle of Ely district. Must have experience of general office routine, be typist and able to take charge in directors absence. Progressive salary to live man. Reply giving full details and salary required, to—Box 9011.

CLERK required to operate Kardex system. Must be quick and accurate with figures. Responsible position. Please reply in writing, giving details of experience, to—Aerialite Limited, 20-22, Craven Road, London, W.2. 6410

CONSULTING engineer requires junior electrical engineer/draughtsman, age 21-25, to be employed in installation design of factories, offices, schools, etc. Superannuation scheme, meal vouchers. Applicants must state salary required, qualifications, age, educational background and experience. Apply—G. H. Buckle & Partners, 2, Harrington Gardens, London, S.W.7. 6476

CONTRACT engineering assistant required by consulting engineers for detailed engineering work on 132 kV and 275 kV substations. University degree or similar graduate qualifications essential plus some practical experience with substations for these voltages. Age under 30 preferred. Salary according to qualifications and experience. Interviews Glasgow or London. Apply with full particulars, to Ref. D.S.H., Kennedy & Donkin, 4, Somerset Place, Glasgow. 6290

CONTRACTORS, old-established and progressive, invite applications for posts of: (a) Experienced estimating engineer; (b) Designer draughtsman able to design electrical installations of all descriptions; (c) Junior for (a) or (b). The posts offer good prospects and salary, also visits to sites. Write in confidence to Managing Director, Alliance Electrical Co. Ltd., 2, Henrietta Street, London, W.C.2. 190

CONTROL gear engineers for circuit and board layout design. Must have sound experience of general industrial requirements in electrical engineering. Up to £750 according to experience and qualifications. West Middlesex. Canteen, pension scheme, housing assistance. Apply with full details to—Box 6190.

CROMPTON PARKINSON Limited require a service engineer for their stud welding organisation in the London area. The position carries sales responsibilities and applicants should be capable of co-operating with customers at all levels. Experience of electro/mechanical servicing combined with some welding knowledge would be an advantage. Full training will be given. Excellent working conditions, 5-day week, superannuation scheme. Apply for staff application form to—Ref. USer, 1/3, Brixton Road, London, S.W.9. 6402

CROMPTON PARKINSON Limited require a young electrical engineer for outside sales. Must have at least two years' commercial experience with fractional horsepower motors. Please write, stating education, age and experience, to —MD/P/FHP, Crompton Parkinson Ltd., Crompton House, Aldwych, London, W.C.2. 6401

CROMPTON PARKINSON Limited require sales engineers for the indoor sales staff at their Chelmsford works. Applicants must have had a sound technical training and previous experience in handling enquiries relating to A.C. and D.C. rotating plant and control gear up to 1,500 h.p./kW. Superannuation scheme. 5-day week. Canteen, social and welfare facilities. Apply stating age, whether married or single, and giving full details of previous experience and training to the Personnel Officer, Crompton Parkinson Limited, Chelmsford, Essex. 6263

DRAUGHTSMAN required at consulting engineers' Glasgow office to assist on layout of 132 kV substations. Experience of this work desirable. Preference for man aged 20 to 28 with, or training for, H.N.C., and suitable for helping on construction supervision and/or contract work later. Salary according to training and experience. Interviews Glasgow or London. Applications with full particulars, to Ref. D.S.H., Kennedy & Donkin, 4, Somerset Place, Glasgow. 6291

DRAUGHTSMEN required by electrical engineering industry in South Wales. Full particulars giving age, experience, education and salary required, to—Box 6455.

DRAUGHTSMEN required, preferably with experience of medium voltage metalclad industrial switchgear. A.E.S.D. rates of pay and bonus scheme, non-contributory superannuation scheme also in operation. Assistance with housing will also be given if necessary to selected applicants. The company is within 6 miles of the South Devon coast. Write stating experience, age, etc., to Ottermill Switchgear Ltd., Ottery St. Mary, Devon. 6477

DRAUGHTSMEN (senior jig and tool) experienced in the design of press tools for the mass production of precision stampings and press parts. Knowledge of progression tools and their application to dieing presses an advantage. High salaries offered to draughtsmen with this specialised experience. Apply in writing giving details of experience and salary required to — G. W. M., M.K. Electric Ltd., Wakefield Street, Edmonton, London, N.18. 6191

ELECTRICAL contractors Central London require assistant engineer. Young man, 25/35, preferred, one capable handling medium-sized contracts at all stages on own initiative. Please reply giving details of experience to—Box 6264.

ELECTRICAL contractors require experienced estimator for industrial and commercial power and lighting work.—The Midland Electric Installation Co. Ltd., Cyprus Works, Upper Villiers Street, Wolverhampton. 6343

ELECTRICAL draughtsman. National Certificate standard or equivalent in electrical engineering. Experienced in electrical switchgear and distribution diagrams, automatic contactor switchgear for motor control. Previous paper mill experience preferred. Apply in writing, giving details of age, training and experience, to—Bowaters United Kingdom Pulp and Paper Mills Limited, Thames Division, Northfleet, Kent. 6399

ELECTRICAL draughtsmen able to work with minimum supervision required by power station contractors, for work on nuclear power development. 5-day week, superannuation scheme, good prospects and salary commensurate with qualifications and experience. Office situate south of Manchester. Write fully in first instance to—Chief Draughtsman, Box 6425.

ELECTRICAL engineer, A.M.I.E.E., or equivalent, with some years' practical experience, required by small but expanding company, to take charge of development of electrical apparatus (incorporating small transformers) now being marketed with great scope in transport and general industry. Initial salary £1,000-£1,500 p.a. according to experience. Good prospects. — Power Frequency Heating Ltd., Alexandra Road, Hounslow, Middx. 6215

EXPANDING hearing aid firm has vacancy for expert technician. Must be conversant with all recent developments. Offers rapid promotion to suitable man.—Box 6450.

ELECTRICAL engineer required as assistant in section dealing with the design of power plant for telephone exchange contracts. Knowledge of A.C./D.C. control circuits and draughting experience an advantage. Write, giving full details of training and experience, to the Personnel Officer, Ericsson Telephones Limited, Beeston, Nottingham. 6427

ELECTRICAL engineer required as branch manager (Manchester area) of established electrical contractors. Applicants should have sound knowledge of electrical contracting industry. Reply in strict confidence giving full details of experience and salary required to—Box 155.

ELECTRICAL engineer required by Engineering Service Installations Ltd., 258, Gray's Inn Rd., London, W.C.1. Experience in design preparing specifications and estimating for all types of electrical installations. Canteen facilities, superannuation scheme. Please write, giving details of experience and salary required, marked confidential—Manager, Electrical Department. 6403

ELECTRICAL engineer required by major oil company in the Middle East to execute electrical engineering projects through the various stages, including design supervision of draughting preparations of specifications, bills of quantities and indents. Applicants should hold a degree in electrical engineering or possess equivalent qualifications, and have had at least 5 years' experience of refinery electrical projects, including drawing office work. Candidates should have a working knowledge of high tension transmission and distribution systems, flame proof industrial and domestic electric equipment. Aged 27-35 years. Two year tour of duty followed by paid home leave. Married accommodation and free air passages available. Salary £2,650 per annum net. Write for application form, stating age, qualifications and giving brief details of experience, to—Box ER.131, c/o 191, Gresham House, London, E.C.2. 6426

ELECTRICAL engineering draughtsmen of H.N.C. standard required. Applicants must be experienced in the preparation of schemes and estimates for illumination and electrical equipment of industrial buildings and H.V. and M.V. electrical distribution schemes. Experience in heavy D.C. distribution systems is desirable. Minimum starting salaries for draughtsmen of H.N.C. standard are from £747 p.a. at age 25. Conditions include a contributory superannuation fund, family education schemes, and some assistance with house purchase. Apply, stating age, qualifications and experience, to the Works Personnel Officer, Pilkington Brothers Ltd., Cowley Hill Works, St. Helens, Lancashire. 6337

ELECTRICAL engineer/draughtsman. A large establishment in the West-end of London require an electrical engineer/draughtsman with H.N.C. and practical works experience for control of maintenance work and new installations. Age 25 to 30 years. Commencing salary £850 per annum. Permanent and pensionable position. Applications with full details, to—Box EE14, Harrods Advertising Agency London, S.W.1. 6478

ELECTRICAL engineers. The General Electric Co. Ltd. have vacancies in their business development department concerned with the complete design of electrical installations in building projects, for qualified engineers with practical experience in this type of work. Apply in writing, giving details of qualifications and experience and quoting ref. BD, to the Staff Manager, Magnet House, Kingsway, London, W.C.2. 6400

ELECTRICAL instrument test room assistants required with experience in wiring, calibration and testing of electrical measuring instruments. Apply in writing to—Everett, Edgcumbe & Co. Ltd., Colindale Works, Hendon, London, N.W.9. 6428

ELECTRICAL supervising and estimating engineer required in East Anglia, capable of estimating and supervising jobs up to £10,000. Good salary and prospects, pension scheme, etc. Apply in confidence, giving age, experience and salary required.—Box 6243.

ENGINEER-designer and designer-draughtsman, for design and development of M.V. switch and control gear; these positions offer first-class opportunities for applicants with necessary qualifications and experience. Write in first instance, stating age, experience, etc., to the Secretary, The Wallacetown Engineering Co. Ltd., Viewfield Road, Ayr. 6344

ESTIMATING engineer required by electrical contractors. 5-day week and superannuation scheme. Written application only, stating experience and salary required, to—Marryat & Place Ltd., 40, Hatton Garden, London, E.C.1. 6241

EXPERIENCED electrical breakdown man required urgently. Experienced in all types of electrical machinery. Suitable accommodation found for the right man. Apply—Collins Electrical Ltd., 22, St. Albans Place, Upper Street, London, N.1. 6404

INSPECTOR (mechanical) foreman required for staff appointment by manufacturers of electrical insulation. A.I.D. approval an advantage. Successful applicant will be required to join company's pension and life assurance scheme, and new town housing will be available if he is at present residing in the Greater London area. Write for application form to—Langley London Limited, Kelvin Way, Crawley, Sussex. 6479

JOHNSON & PHILLIPS Ltd. have vacancies for young electrical engineers who have completed their training and National Service. Minimum qualification H.N.C. Good prospects for suitable candidates. Applications, giving particulars of training, qualifications and age, to —Manager, Employment and Welfare Dept., Messrs. Johnson & Phillips Ltd., Victoria Way, Charlton, London, S.E.7. 6405

JUNIOR engineer required by London electrical contractor. Must have had practical experience on medium-sized factory installations and be prepared to travel abroad on short terms 3-9 months as occasion arises. Full particulars to Managing Director.—Box 6327.

LINESMEN and mates for work on H.V. and L.V. lines in the West Midlands. Apply in first instance to—Box 6245.

MANAGER required by industrial electrical contractors for small branch office in Warwick. Experienced in labour control, estimating and finalisation of accounts. Apply in writing giving details of experience and salary required.—Managing Director, E.P.I. (B'ham) Ltd., St. Martins Row, Birmingham, 1. 6375

MARINE electrical engineer required. Must be capable of designing and estimating electrical installations in ships up to 2,000 tons and supervising the work to completion. Good salary and prospects, pension scheme, etc. Apply in confidence, giving age, experience and salary required, to—Box 6244.

MARINE radar instructor required at Leicester factory for instructing ships' officers and servicing personnel in the operation and maintenance of marine radar equipment. Occasional visits to ship are a part of the duties. Previous radar servicing experience desirable. Apply—Construction Department, The British Thomson-Houston Co. Ltd., Rugby. 6406

MEDIUM size high-class quality electrical accessories manufacturer requires junior representative, aged 23-24, to work in the Southern Electricity Board area, preferably living in Reading.—Box 6429.

MERZ AND McLELLAN have vacancies in their Esher office for electrical engineering draughtsmen. Applicants should be experienced in plant layout work, cabling, etc., preferably, but not essentially, in connection with steam power stations. Salaries will be fully appropriate to applicants' experience, rising from about £780 per annum at age 25. Excellent working conditions. Five-day week, pension scheme, canteen. Apply in writing to —Merz and McLellan, Milburn, Esher, Surrey. 6315

NATIONALLY-known domestic appliance company with attractive lines is considering change in selling policy involving the appointment of agents in all areas. Consideration will be given to the handing over of valuable existing accounts. Established agents calling on domestic appliances and hardware dealers should write with full details of coverage to the Managing Director, Box 6430.

REPRESENTATIVE required by old-estd. electrical distributors for Hammersmith area. Applicants residing and with connection in this area will receive preference. Car an advantage but intimate knowledge of trade is essential. Write stating full details of experience, with age, to—Box 6328.

REQUIRED, young assistant engineer with good knowledge of construction of H.V. and L.V. overhead lines in West Midlands. Apply in first instance to—Box 6246.

PILKINGTON BROTHERS Limited, who are the largest manufacturers of plate and sheet glass in the British Commonwealth and employ more than 20,000 persons, wish to appoint a head of their technical development department. This is a new appointment necessitated by the large number of development projects in hand. It is intended that the man selected should take charge of the development of new processes and the radical improvement of existing ones. There are ample technical resources available and the company spends large amounts on development work. Applicants must have a good Honours Degree in engineering, physics or chemistry. They must also have a flair for development work, and the enthusiasm to see a job through. Applications will be welcomed from men aged preferably 35/45 who have done at least 5 years' successful and original development work in industry or at a University. The company is prepared to offer a service agreement at an attractive salary to the right man. All applications will be treated confidentially and should be addressed to the Group Personnel Officer, Pilkington Brothers Limited, The Glass Works, St. Helens, Lancashire. 6376

SENIOR electrical engineer to take charge of projects required for consulting engineers' office, carrying out the design of lighting and power installations for all classes of buildings. Five-day week, spring and summer holidays, pension scheme and luncheon vouchers. Apply in writing, stating age, experience and salary required, to—J. Roger Preston & Partners, 15, North Audley Street, London, W.1. 6407

SMALL firm manufacturing mica components for electronic and radio trades has opening for a respectable young gentleman as working partner, preferably with a small capital. Ability of salesmanship and knowledge of press tools essential.—Box 6449.

SOUTH WALES SWITCHGEAR, Ltd., Blackwood, Mon, have vacancies for experienced draughtsmen. Applications giving age, experience, etc., to the Personnel Manager. 6456

STORES and clerical assistants reqrd. Knowledge of trade and equipment desirable. Good prospects. Pensionable.—London Electrical Co., 92, Blackfriars Rd., London, S.E.1. 6267

STORES assistant required by electrical wholesalers (London). Preferably experienced and able to drive. Present staff notified of vacancy. Write details, experience, salary required, etc.—Box 6480.

SUPERINTENDENT engineer required for the Baghdad Electricity Services. Application invited from qualified engineer for new 8-MW diesel plant. Previous experience in similar position required. Monthly Salary I.D. 150, plus high cost-of-living at present I.D. 20 per month. Passage paid first class including wife and children under 16. Free house with heavy furniture. 3 months' vacation home on full pay after 2 consecutive summers in Iraq. Provident fund exists. Age limit 40. —Box 6378.

TELECOMMUNICATIONS engineers and laboratory assistants required, preferably H.N.C. standard, familiar with development of or measurements on capacitors, transformers or telecommunications components. Interesting work, good salaries and conditions with an A.E.I. company. Write stating training, experience and salary required to Staff Officer, Ref. 744/79, Siemens Brothers & Co. Ltd., Woolwich, London, S.E.18. 6177

THE DECCA NAVIGATOR Company Limited has vacancies for project engineers and installation engineers for work in connection with low frequency transmitting stations. Applicants for the post of project engineer should have received training in electrical and radio theory and have obtained extensive practical experience. The duties will cover all aspects of the planning of complete installations and will demand some travelling both at home and abroad. Applicants for the post of installation engineer must have experience of the installation and commissioning of electrical and radio equipment and preferably should have received some technical training. Vacancies will arise for senior installation engineers to take charge of teams. Considerable travelling at home and abroad will be required. Applications, giving brief details of experience, training and salary required, should be addressed to—The Decca Navigator Co. Ltd., 247, Burlington Rd., New Malden, Surrey. 6408

TRANSFORMER designer (senior) required. Applicant must have wide experience in design and manufacture of units up to 250 kVA. Promotion to directorship offered after qualifying period with commensurate salary and bonus. Housing accommodation if required. Replies will be treated in strict confidence.—Stewart Transformers Ltd., 75, Kilburn Lane, London, W.10. 6292

TRANSFORMER draughtsmen, senior and junior, required with experience in power transformers up to 10,000 kVA. Salary according to experience. Pension and life assurance scheme, canteen facilities, 5-day week. Write stating experience, qualifications and age to—Chief Mechanical Engineer, Hackbridge & Hewittic Electric Co. Ltd., Walton-on-Thames, Surrey. 6247

TRANSFORMER sales engineer required for electronic and power units to 150 kVA. Preferably with previous experience. Write, stating full details, in confidence to—Edlin Electrical Equipment Co., 5, Edwin Road, Twickenham. 9009

TRANSFORMER test engineer required to take charge of test-bed dealing with units up to 10 MVA. Candidate should be capable of carrying out complete tests to the satisfaction of inspecting engineers. Write stating experience and salary required to—Chief Engineer, Bryce Electric Construction Co. Ltd., Kelvin Works, Hackbridge, Surrey. 6216

TRANSFORMER testing. Chief of test required with experience in testing high-class transformers, L.F. chokes and power transformers up to 250 kVA. Salary commensurate with experience. Apply — Willesden Transformer Co. Ltd., Manor Park Works, Manor Park Road. Harlesden, London, N.W.10. 312

WAREHOUSEMEN, experienced, required for electric cables and television aerials. Good wages, superannuation scheme. Please reply in writing to—Aerialite Limited, 20-22, Craven Road, London, W.2. 6409

WORKS manager. An able energetic man who has comprehensive knowledge and experience in manufacturing electrical machinery. Considerable scope for a first-rate man in well-known Midlands organisation. Give full details of experience, salary and age.—Box 6266.

WEST Africa. Engineering and contracting company in West Africa requires electrical engineer with administrative and sales experience as manager of one of its branches. Age 30/45. Salary £1,800 to £2,000 per annum, according to age and experience, plus allowances and commission. Suitable applicants will be interviewed in London mid-July. Write, giving full particulars, to—Box "E.O.," c/o J. W. Vickers & Co. Ltd., 7/8, Great Winchester Street, London, E.C.2. 6481

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

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BUYER/manager (37), 16 yrs.' experience. Conversant all aspects electrical wholesaling plus technical knowledge. Immediately available London or Home Counties in similar capacity.—Box 9018.

ELECTRICAL engineer, aged 32, Grad. I.E.E., previous service overseas, seeks interesting responsible appointment, West Indies, South America, East Africa. Wide experience, distribution, machines, etc.—Box 9021.

EXPERIENCED representative, age 42, resident Leicester, with connection in M.E.B. and E.M.E.B. areas requires position commencing 1st September.—Box 9019.

FOREMAN electrician seeks change. Public works, industrial, domestic. Complete supervision.—Box 9020.

REP., first-class comm. and indust. conn. East Anglia and South Midlands, seeks change.—Box 9005.

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THE Corporation has for disposal one Lead Acid Storage Battery, consisting of 50 cells, 75 amperes hour capacity, in Glass Boxes, complete with stands, all in good order. The battery may be inspected at the Head Office of the Transport and Electricity Department, Manors, Newcastle upon Tyne, any weekday between the hours of 9 a.m. and 5 p.m.

Offers in a sealed envelope marked "Offer for Battery," should reach me, the undersigned, not later than 11th July, 1957.

JOHN ATKINSON,
Town Clerk.

Town Hall,
Newcastle upon Tyne, 1. 6482

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

Sale by Tender of Motor Generator Plant

THE Board have for disposal and invite tenders for the purchase of two Motor Generator Sets (6/6.6-kV Motor, 460/520-v., D.C. Generator), complete with starter and L.T. voltage regulator, also 8-panel D.C. 3-wire distribution board.

Further details, full particulars as to where they may be inspected, and forms of tender on which offers must be submitted, may be obtained on application to the Manager, No. 4 Sub-Area, Merseyside and North Wales Electricity Board, Electricity House, Rhostyllon, Wrexham. Tenders must be returned in a sealed envelope, addressed by means of the endorsed label provided, so as to arrive not later than noon on Friday, the 5th July, 1957.

The equipment is offered for sale without guarantee as to its condition, and the Board do not bind themselves to accept the highest or any tender and reserve the right to accept the whole or any part of any tender.

M. M. PARKER,
Secretary.
6431

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All 440 volts, 3-phase, 50 cycles

2 15-h.p., 965 r.p.m., with Metro-Vick Star-Delta Starters.
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One 5 h.p., 950 r.p.m.
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New 200-h.p., 6,300/3/50, 750-r.p.m. CROMPTON PARKINSON auto synchronous motor.

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(Phone, Shirley 3303) 6432

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co., Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A NUMBER of secondhand electric motors offered for sale including 15-h.p. E.C.C., 30-h.p. B.T.H. with contactor starter, 2 28-h.p. E.C.C. (one with pony starter) and Brookhirst switchgear starters, 1 27½-h.p. Crompton Parkinson slipring motor with Allen West starter and ½-h.p. A.C. motor. All 3-phase, 400/440. Available for inspection. Offers invited for single motors or offer for the whole to clear. Apply—J. Alsford Ltd., Twickenham Road, Hanworth, Feltham, Middx. 164

A.C. and D.C. house service meters, all sizes, quarterly and prepayment, reconditioned, guaranteed one yr. Repairs and recalibrations. —The Victa Electrical Co., 47, Battersea High Street, S.W.11 (Tel. Battersea 0780). 138

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- Slotmeters. Guaranteed 2 years, 2½-50 amps. From 50/- Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

ALTERNATORS from ½ to 675kVA in stock, single and three-phase, all voltages and frequencies. Guaranteed. Many unused. Send your requirements.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, generators, 1-100 kVA, all voltages. Specialists—Powerco Ltd., York Rd., London, S.W.18 (VAN. 5234). 147

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

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CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 3

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POWER factor condenser, 50 kVAR, Bryce, oil immersed, 400/440-3-50.—J. S. Ramsbottom & Co. Ltd., Elec. Engs., Keighley (3774/5/6). 6486

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RECTIFIER, maker Westinghouse. Primary, 400 volts, 3-phase, 50 cycles; secondary, 30-40-50-60 volts D.C., 800 amps., intermittent rating.—Whitefield Machinery & Plant Limited, Cobden Street, Salford, 6 (Tel. Pen. 4746). 6268

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VENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

WARD Leonard motor generator sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

¾-h.p., D.C. motors. 12 off new Higgs, 220/230 volts, 1,450 r.p.m., compound, £10 ea. —J. S. Ramsbottom & Co. Ltd., Elec. Engs., Keighley (3774/5/6). 6488

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1,000 new storage cells for sale, heavy duty, 570 amps., ebonite container and sealed covers. Orig. made for Admiralty, packed 4 per wood case for transit. Low price for quantities.—Burleigh Alpine Works, Empire Way, Wembley (Tel. 0211). 324

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RELIABLE, self-contained diesel electric generating sets for hire, 2.5 to 260 kW. Night and day maintenance service. Quotations by return.—Whitetrade Limited, Rochester, Kent (Tel. Chatham 4638/9). 294

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A.C., 220-v., 3-phase, 60-cycles electric motors, and generating sets, and other electrical equipment. Send full details to—E. M. Tatton & Co. Ltd., Electrical Engineers, Kew Bridge, Brentford (Ealing 3155). 6318

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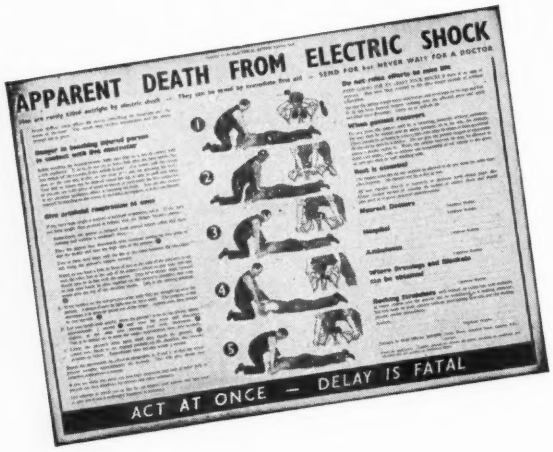

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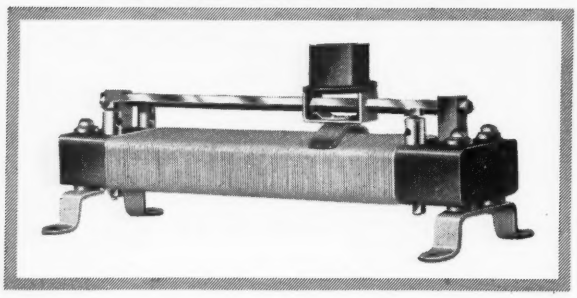

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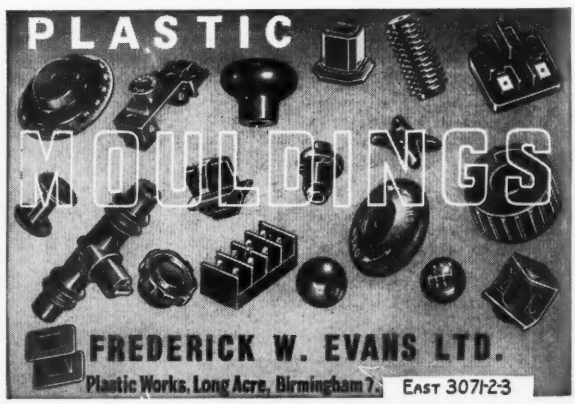

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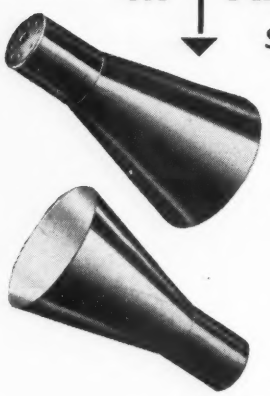

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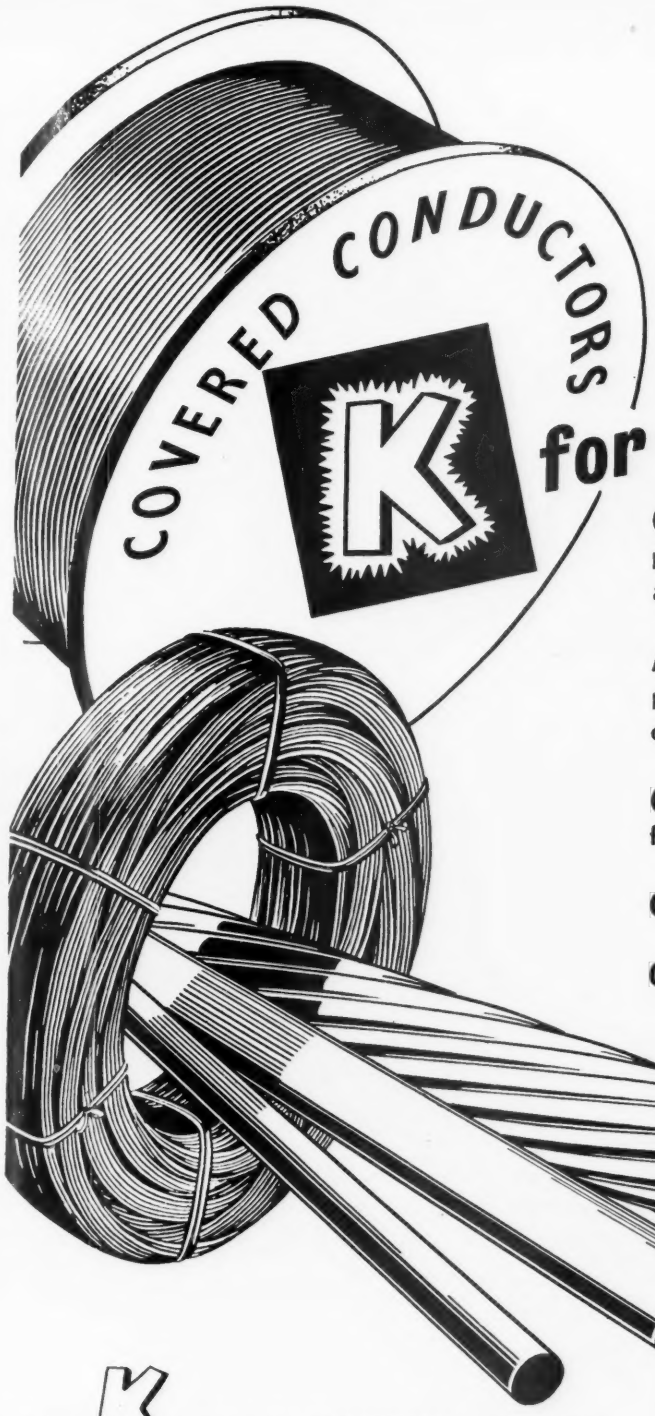

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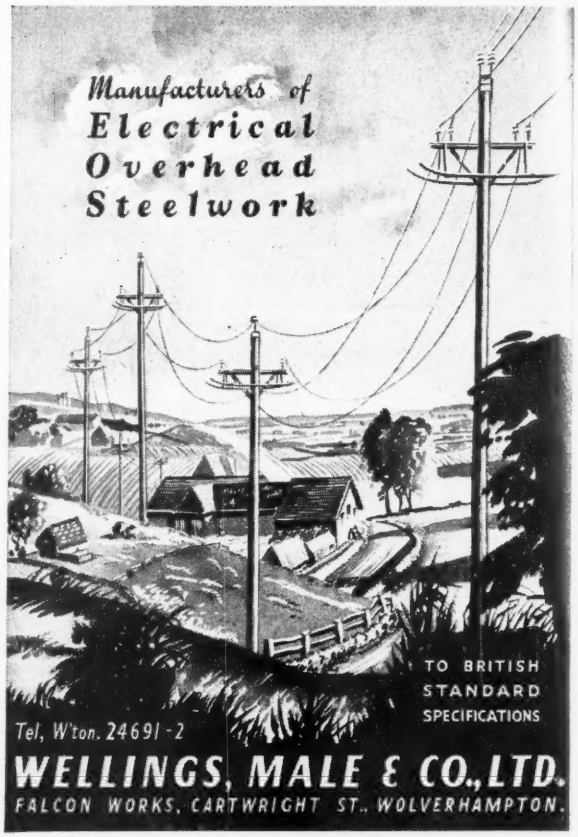

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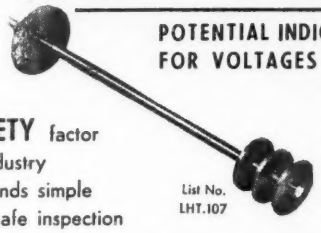

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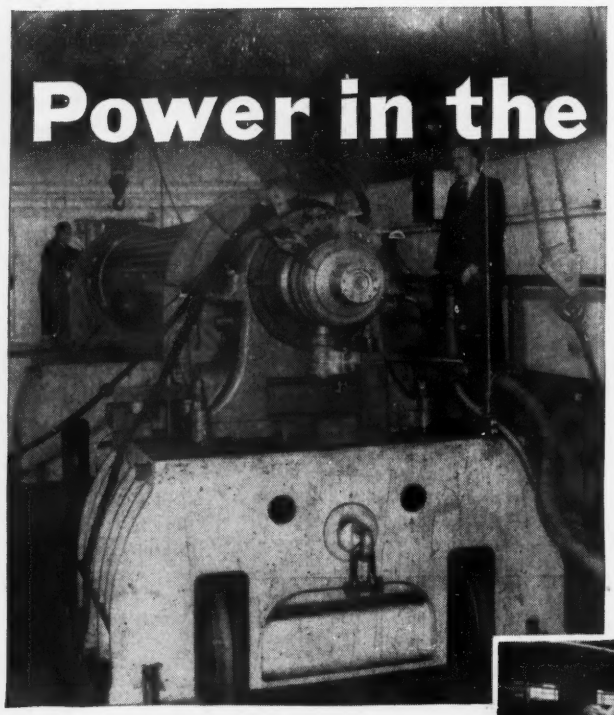

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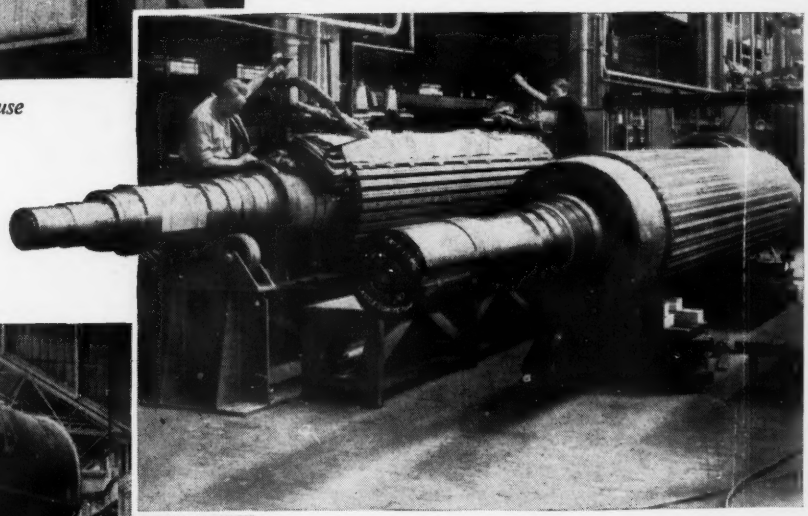
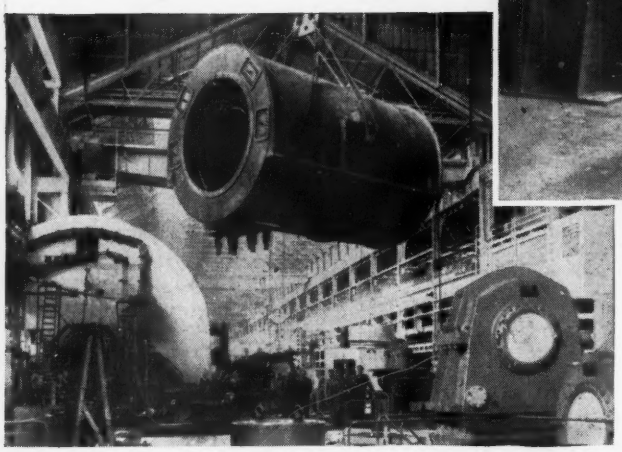


Winding the rotor



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